SYSTEM BRIEF DETAIL

Report detailing the testing of an HPL rainscreen cladding system tested in accordance with the requirement as described in British Standard 8414

Ministry of Housing, Communities & Local Government

CUSTOMER TEST REPORT

BS 8414-1-2015+A1-2017 Test Report

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Prepared for:
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and Local Government
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London
SW1P 4DF

Report Date(s): 21/06/2019

Report Reference: 101856.8414 Version number: 01

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Review

Approval	Name	Date
Author	[redacted]	21 June 2019
Reviewed by	[redacted]	25 June 2019
Reviewers signature	[redacted]	

Distribution

Name	Company

Document version history

Version	Date	Superseded documents/description/details
01	21/06/2019	Initial issue

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- Any references made to this work must be accompanied by provision of the full, unabridged, report.
- The report does not imply that FPA believe the BS8414 test regime alone is appropriate for the guarantee of end-use system performance.

Contents

1 Introduction

The test method, BS 8414-1-2015+A1-2017 describes a method of assessing the behaviour of non-load bearing external cladding systems, rain screen over cladding systems and external wall insulation systems when applied to the face of the building and exposed to an external fire under exposed conditions. The fire exposure is claimed to be representative of an external fire source or a fully developed (post-flashover) fire in a room, venting through an opening such as a window aperture that exposes the cladding to the effects of external flames.

This report applies to the cladding system as detailed. The report only covers the details as tested.

The test method does not cover the performance of glazed window openings or the detailing at such openings. It does not apply to curtain walling systems or systems that include glass panels.

Performance Criteria and Classification methodology of the external fire performance covered by this test can be found in report *BR 135: Fire performance of external thermal insulation for walls of multi - storey buildings.*

1.1 Important Note

It is important to note that the BS8414 test described in this test report was terminated early due to a problem with the extinguishing procedure on the test day. As such the full test programme was not completed as per the test standard and the test was deemed null and void.

It is intended that the test will be conducted again, using a fresh installation of the same cladding system.

As a result of the issues described, a BR 135 report could not be completed for this test as the criteria for classification of the cladding system was not met.

2 Details of the test carried out

Name of Laboratory:	Fire Protection Association Ltd
Laboratory Address:	London Road Moreton-in-Marsh Gloucestershire GL56 0RH
Test reference:	101856.001
Date of Test:	18/06/2019
Sponsor:	Ministry of Housing Communities and Local Government
Sponsor address:	2 Marsham Street London SW1P 4DF United Kingdom
Method:	Tested in accordance with BS 8414-1-2015+A1-2017
Deviations:	Test not completed to BS 8414 test standard due to water coming into contact with the main wall of the test rig during the extinguishing procedure of the crib. Test results nullified.

3 Details of test apparatus used (BS 8414-1-2015+A1-2017)

The apparatus is defined in the Test Standard and consists of a steel frame structure with masonry infill to form a vertical main test wall and a vertical return wall at a 90° angle at one end of the main test wall as shown in Figure 1. The main wall includes the combustion chamber.

Aside from apparatus described above, and the applied fuel, all additional items used to for the built up 'system' are considered part of the cladding system under test.

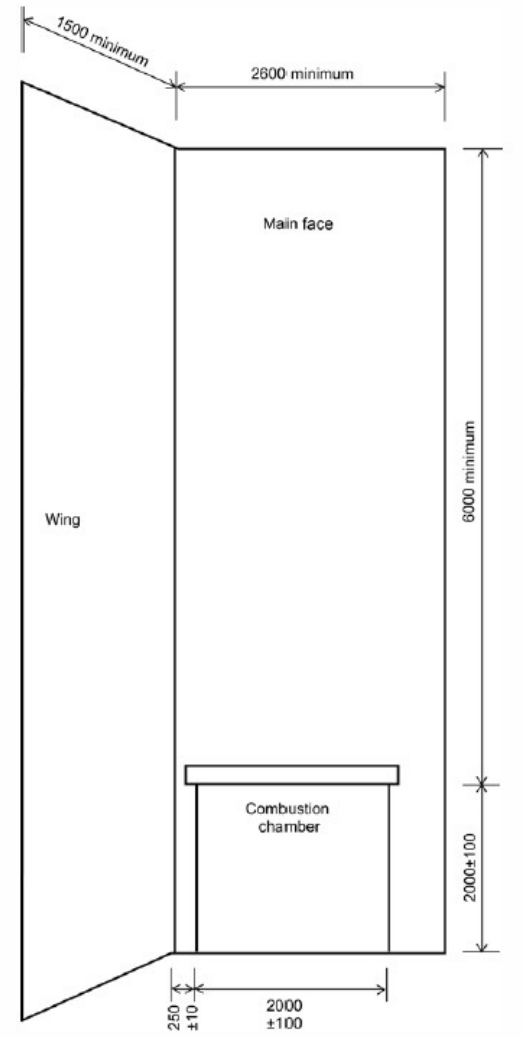


Figure 1 - Test apparatus dimensions [As specified by test Standard Figure 1]

4 Description of the system under test

Aside from apparatus described in Section 3, and the applied fuel, all additional items used to form the built-up 'system' are considered part of the cladding system under test with the potential to impact upon its overall performance. These include, but might not be limited to:

- Façade panels
- Insulation
- Cavity barriers and their rating
- Bracketry
- All fixtures and fittings

Similarly, many assumed design factors pertinent to the installation might also contribute to overall performance such as:

- The building substrate
- Method of panel attachment
- Form of panel
- Insulation thickness / rating
- Void size behind panel
- Panel spacing
- Distance between cavity barriers
- Cavity barrier locations
- Type of cavity barrier used
- Assumed window detailing

Some elements of a cladding system are not by default tested through this test regime which again have the potential to be important to overall performance such as the provision of breaches within the system (e.g. vents and ducts).

Expert consideration of all assumed test design factors will need to be made when using the test data to confirm end-use suitability where deviation in the material specification or design detailing from the as-tested design may exist.

4.1 Description of product

Rainscreen:

10mm [redacted]

- Pre-drilled fixing position holes @ 10mm diameter
- Large flange stainless steel rivets 5x16mm
- 10mm gap between horizontal and vertical joints

Insulation:

180mm [redacted] Insulation Board

- 70mm stainless steel pressure plates and 230mm SDKBV10x Fasteners, no washer. (6no Fixings to every board)
- Vertical & Horizontal Joints sealed with UL723 FR Grade Aluminium 50mm wide foil tape

'Helping Hand' Brackets & Rainscreen Fixing Metalwork:

[redacted] 200mm Brackets

- Single Brackets – 2no SDF-KB-10Vx60E Fixings 32mm Long
- Double Brackets – 2no SDF-KB-10Vx60E Fixings 32mm Long

[redacted] T & L Bars

- Single brackets to bars -2no self drilling stainless steel 4.2mm x 16mm, no washer
- Double brackets to bars – 4no self drilling stainless steel 4.2mm x 16mm, no washer
- 10mm gap between T & L Bars

Cavity Barriers:

[redacted] E90130 Open State Cavity Barrier

- 2no galv brackets per 1200mm Barrier (300mm from ends and C/L) on verticals
- 3no galv brackets per 1200mm Barrier (200mm from ends and one in the centre) on horizontals
- 2no SDFKB10Vx60E, no washer per galv bracket
- [redacted] E90 130 Open State Cavity Barrier – 245mm Overall (10mm compression)
- [redacted] E90 130 Open State Horizontal Cavity Barrier - 210mm overall to allow a 25mm air gap (expands an additional 44mm)
- Foil tape required to every joint (vertical and horizontal) and to horizontal to vertical abutments

4.2 Installation of specimen

The design, installation, procurement and specification of the materials of the cladding system were undertaken by the test sponsor. It was the responsibility of the test sponsor to ensure that all components were install as per the manufacturer's guidelines.

Figure 2 – Finished installation of cladding system under test

4.3 Test conditions

Test date:	18th June 2019
Ambient temperature:	14.7 ˚C
Wind speed:	0.3 m/s
Frequency of measurement:	All temperature measurements recorded at 0.2 Hz
Fuel load	300m softwood pinus silvestris 50mm x 50mm sticks arranged in a stacked crib
Ignition package	16 strips of low density fibreboard, 25mm x 12mm x 1000mm. Uniformly soaked in 5 litres of white sprit.
Fuel load density (average of 4 randomly selected crib sticks)	1.799 kg/dm^3
Fuel load moisture content (average of 4 randomly selected crib sticks)	10.3%

5 Test results

5.1 Fire spread and start time

Test results for the evaluation of fire spread and start time are detailed in the tables below. Temperature profiles recorded during the test are shown in Figure 3 to Figure 7.

Table 1 – Start temperature and start time

Parameter	Result
T_s, Start temperature – the mean temperature of the thermocouples at level 1 during the 5 minutes before ignition	17.87 °C
t_s, Start time – the time when the temperature of any external thermocouple at level 1 equals or exceeds a 200 °C temperature rise above T_s, and remains above this value for at least 30 seconds	100 seconds after ignition of the crib

Table 2 – Peak temperatures measured by level 2 thermocouples within 15 minutes of start time (t_s)

External fire spread								
Level 2, external thermocouples								
Thermocouple ID	1A	2A	3A	4A	5A	6A	7A	8A
Peak temperature (°C)	226.2	358.0	418.0	271.7	174.7	165.2	129.1	98.9
Internal fire spread								
Level 2, thermocouples in tile façade								
Thermocouple ID	1B	2B	3B	4B	5B	6B	7B	8B
Peak temperature (°C)	164.7	446.2	497.8	162.5	93.8	129.0	123.0	95.4
Level 2, thermocouples in cavity								
Thermocouple ID	1C	2C	3C	4C	5C	6C	7C	8C
Peak temperature (°C)	153.8	209.5	238.8	171.7	54.6	125.5	122.3	87.3
Level 2, thermocouples in insulation								
Thermocouple ID	1D	2D	3D	4D	5D	6D	7D	8D
Peak temperature (°C)	n/a*	40.3	54.3	65.0	23.1	38.1	85.0	38.9

**Thermocouple 1D failed during the test and so its results have been omitted from this report.*

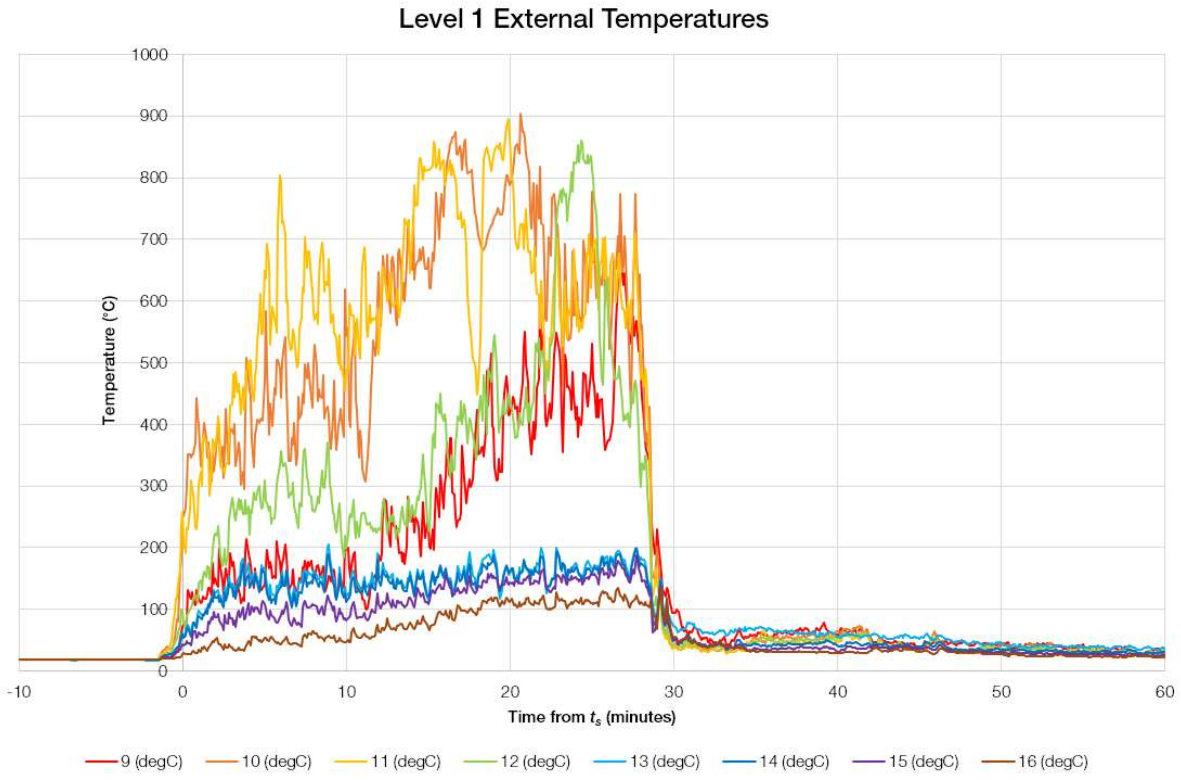


Figure 3 – External temperatures at level 1

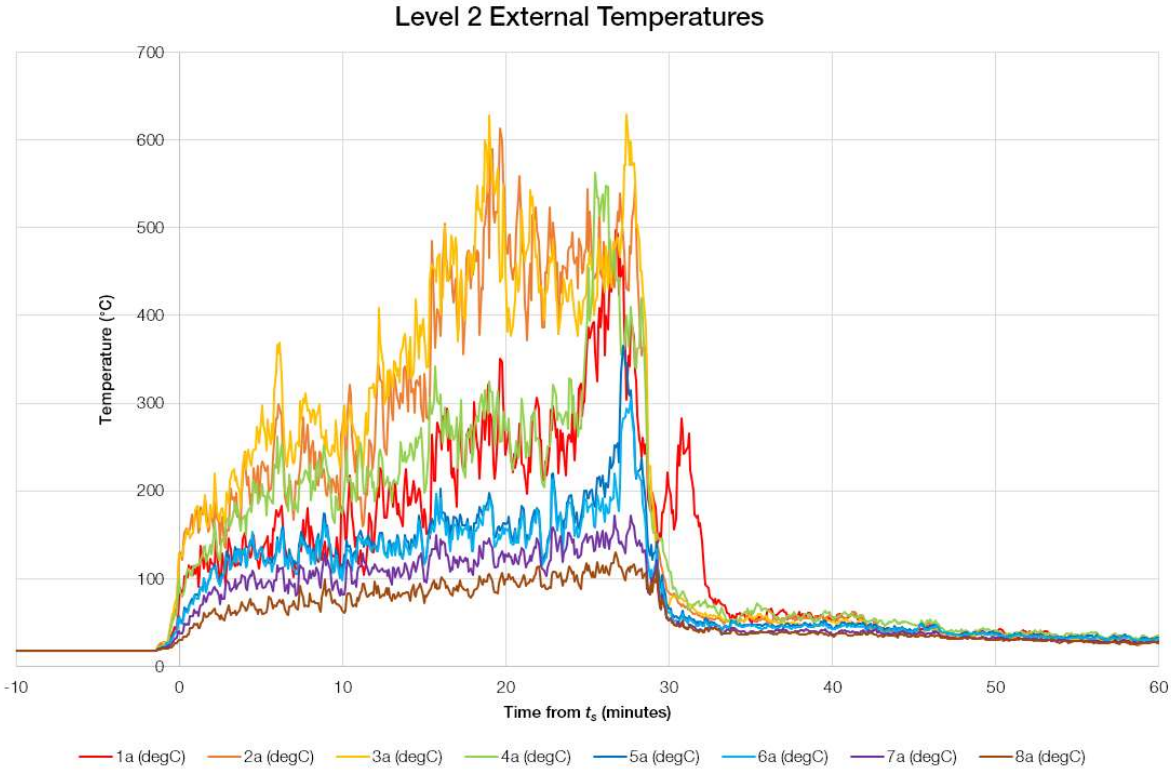


Figure 4 – External temperatures at level 2

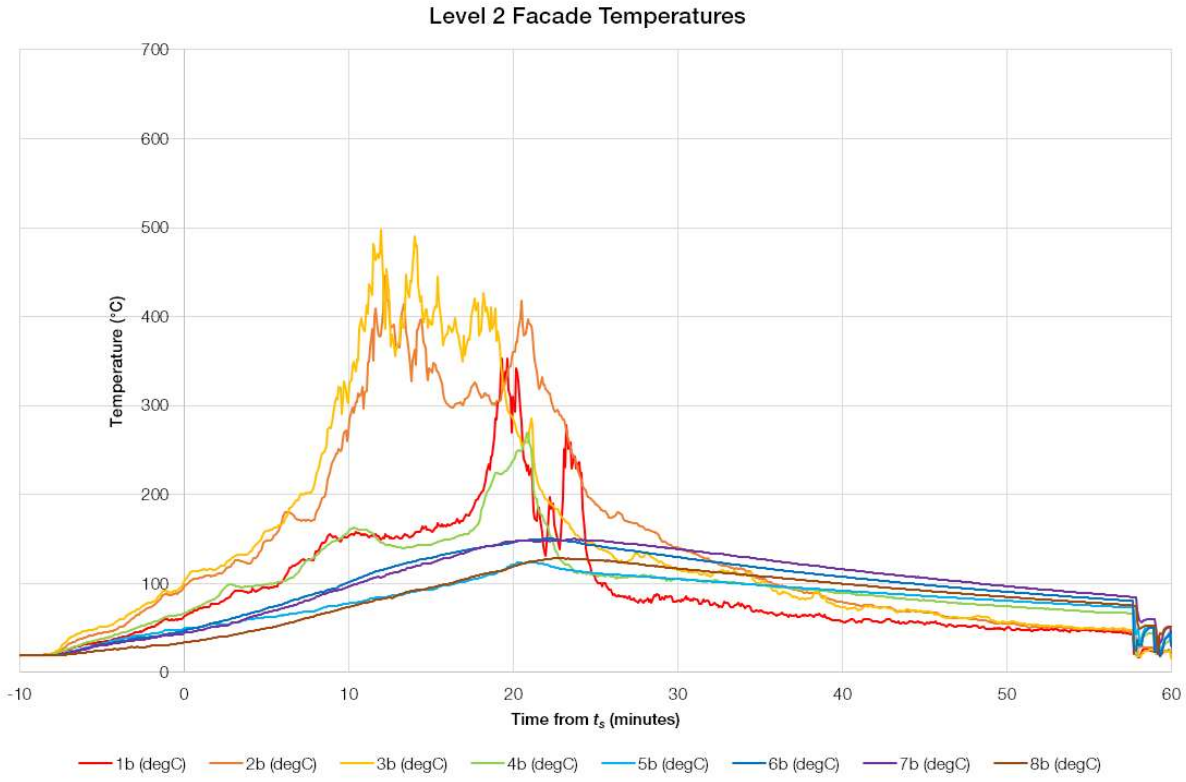


Figure 5 – Façade internal temperatures at level 2

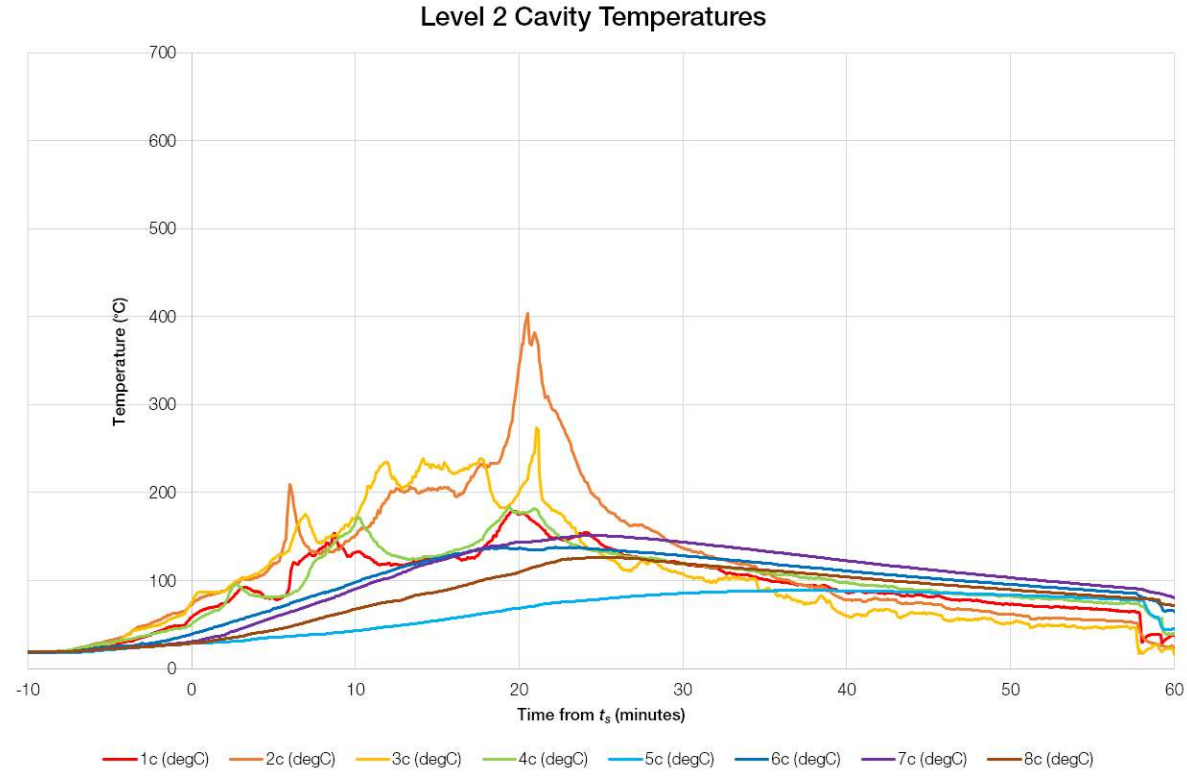


Figure 6 – Cavity internal temperatures at level 2

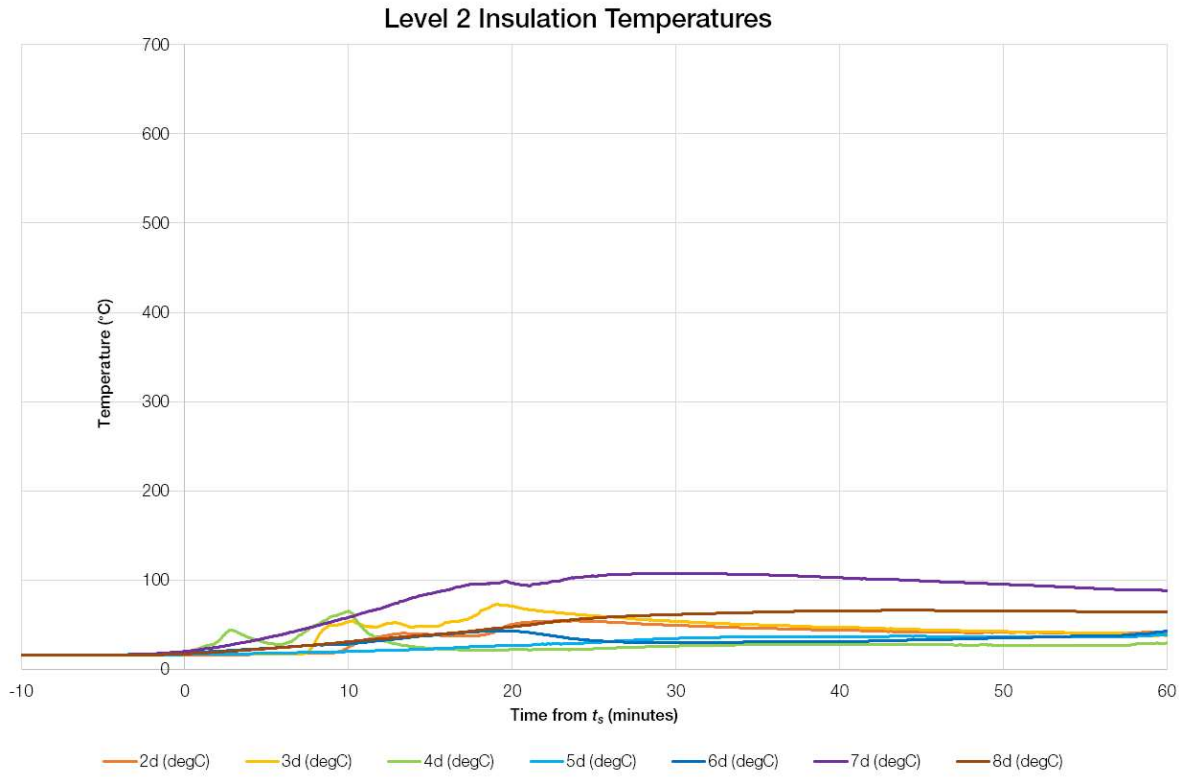


*Figure 7 – Insulation internal temperatures at level 2**

**Thermocouple 1D failed during the test and so its results have been omitted from this report.*

5.2 Visual observations

Visual observations from direct observation are detailed in the table below.
(Where direct observation was unsafe and to augment direct observations, visual observation of test video was also used).

Table 3 – Key tests times and visual observations.

Time from ignition (mins:secs)	Description
00.00	Datalogger and Stopwatch start time
02.00	Fibreboard sticks begin soaking in white spirit
08:40	Fibreboard sticks inserted into crib
10.00	Crib lighting commences
14.00	Surface damage visible on façade panels, directly above fire
15.00	Aluminium frame begins to warp
15.30	Exterior skin of façade panels begins to blister
19.10	Aluminium frame around burn chamber fails
20.40	Small pieces of debris start to fall from facia panels
21.50	Smoke emerging from gaps between lower panels
22.40	Lower façade panels visibly warped directly above fire
23.00	Smoke emerging from behind upper panels
24.00	Façade surface damage reaches upper panels
24.30	Façade surface damage visible on the wing panels
25.00	Surface of lower panels burnt away directly above fire
27.00	Cracks in lower panels directly above fire
29.40	Flames visible from behind the top of the lower panels
30.00	Bottom corners of lower façade panels warped
31.00	Larger pieces of debris falling from panels
32.00	Bottom of lower panels completely bunt away
33.16	Panels on wing wall warped
34.25	Large piece of debris falls from lower panel
36.40	Middle of lower panels, and bottom corners of upper panels burnt away
38.40	Loud audible bangs sounding from system – source uncertain
39.27	Remains of lower right panel falls
40.05	Crib extinguishment commences, water sprayed onto main wall façade panels
41.57	Small flames still visible on the bottom of the upper left panel
70.00	Test terminated

6 Disclaimers

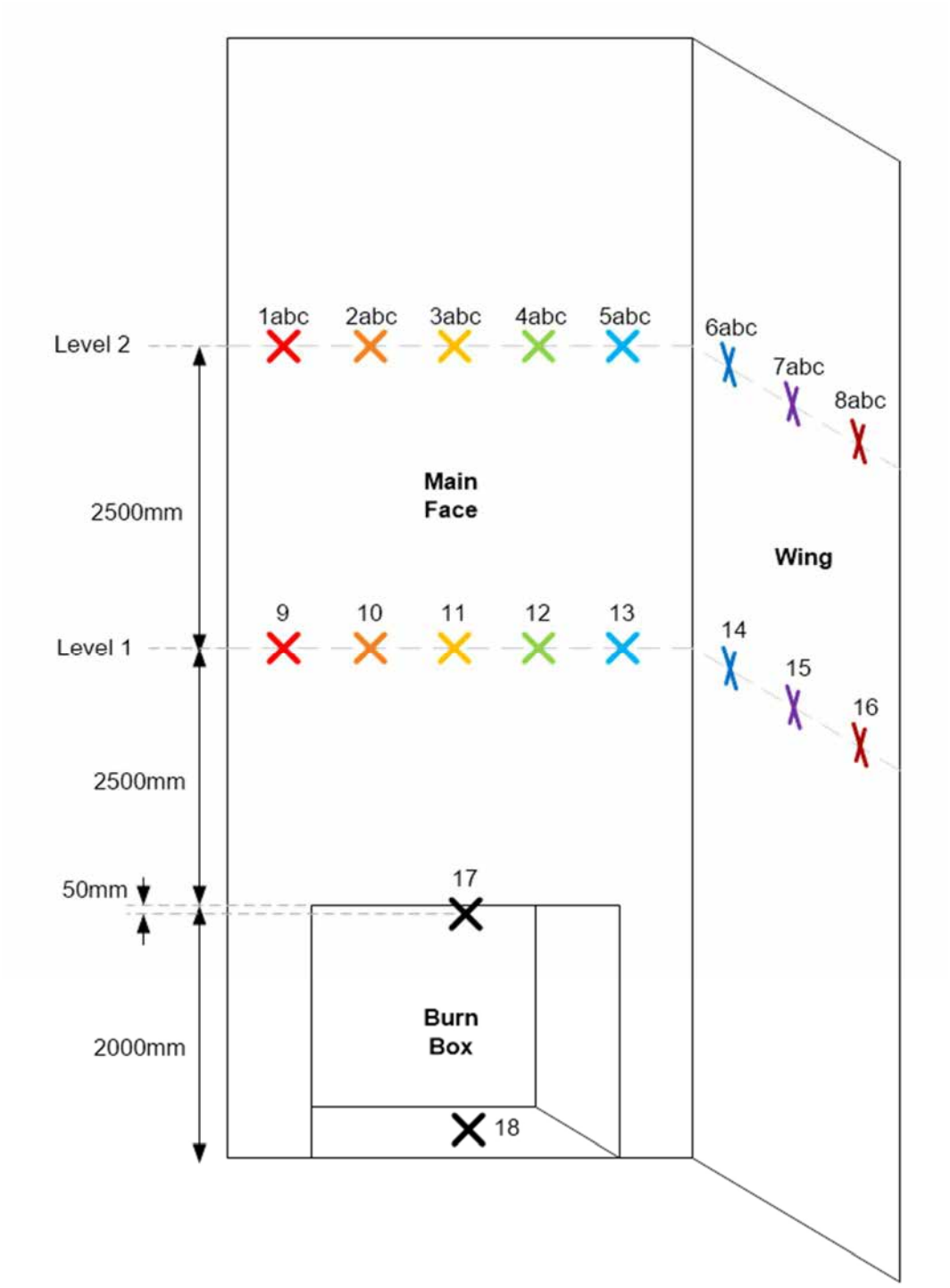
- The FPA is responsible for all the information provided in this report, except when information is provided by the customer.
- The FPA is not responsible for the validity of results that rely on information supplied by the customer.
- The contracted cladding supplier is responsible for providing the installed system for test ('the sample'). Therefore, the results contained within this report apply to the sample as received.

7 References

[1] British Standards Institute, “BS 8414-1:2015+A1:2017, Fire performance or external cladding systems - Part 1: Test method for non loadbearing external cladding systems applied to the masonry face of a building,” British Standards Institute, London, 2017.

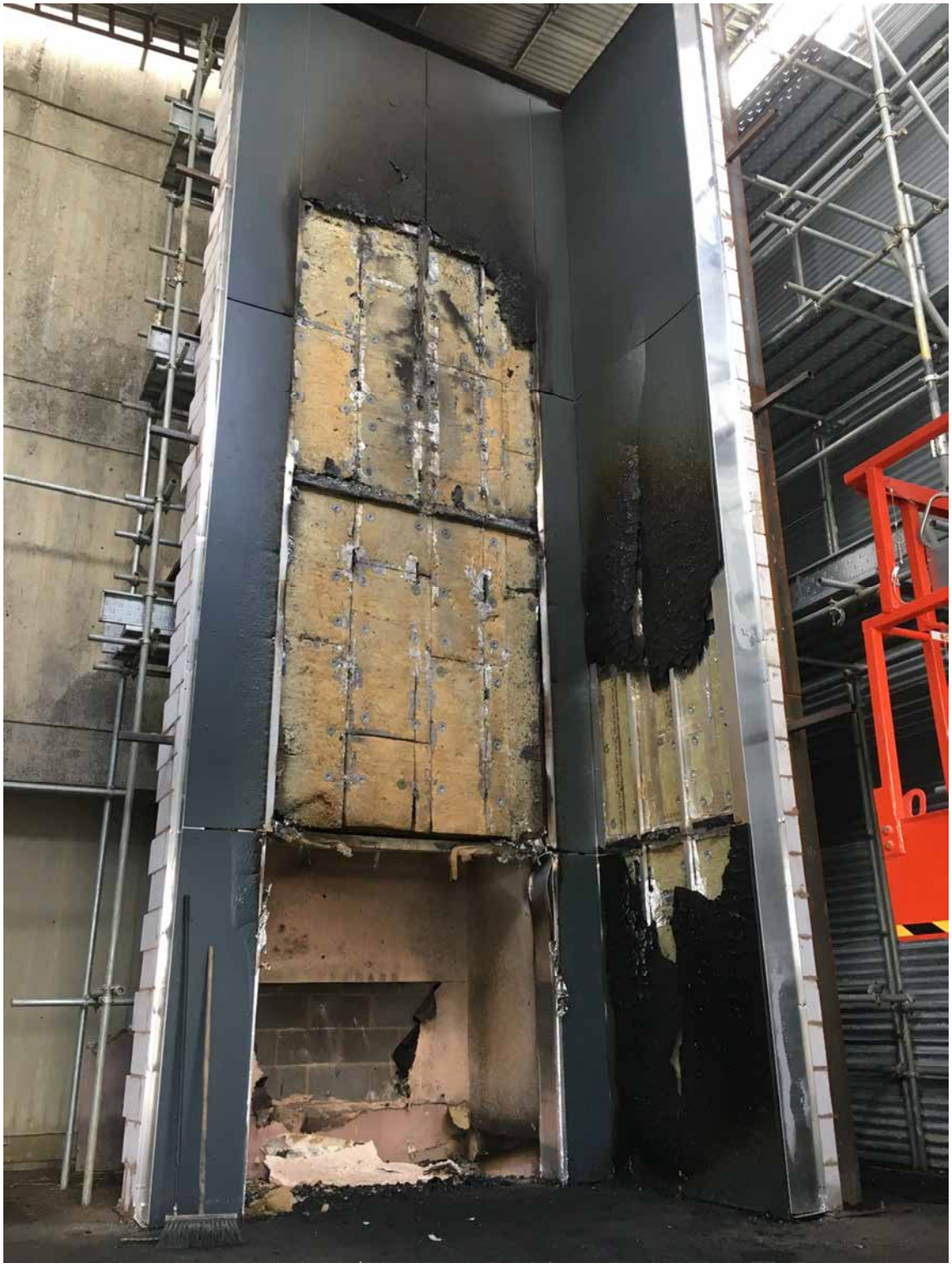
[2] S. Colewell and T. Baker, “BR135 Fire performance of external thermal insulation for walls of multistorey buildings, Third Edition,” IHS BRE Press, Watford, 2013.

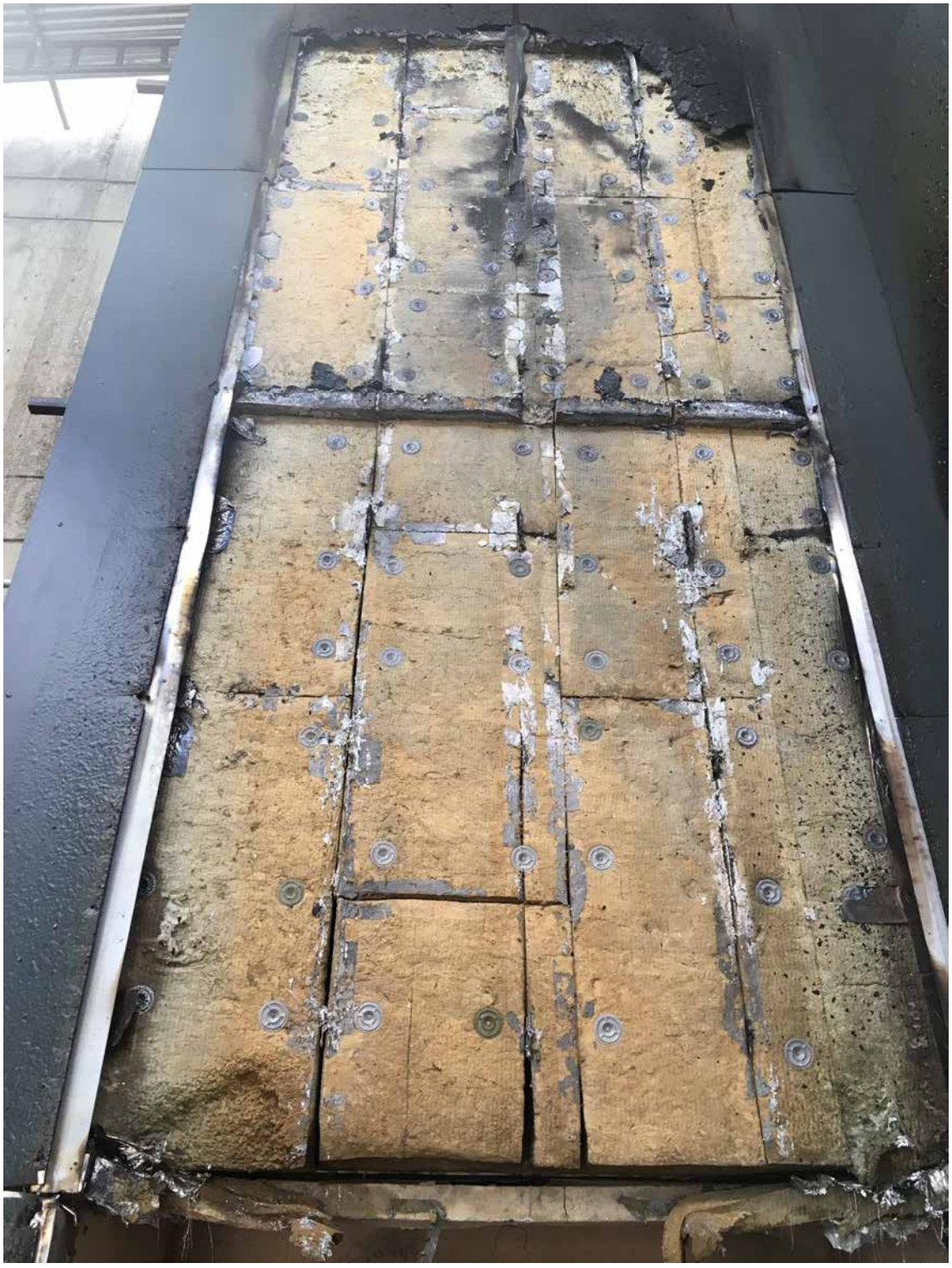
8 Appendix A – Location of thermocouples on test wall

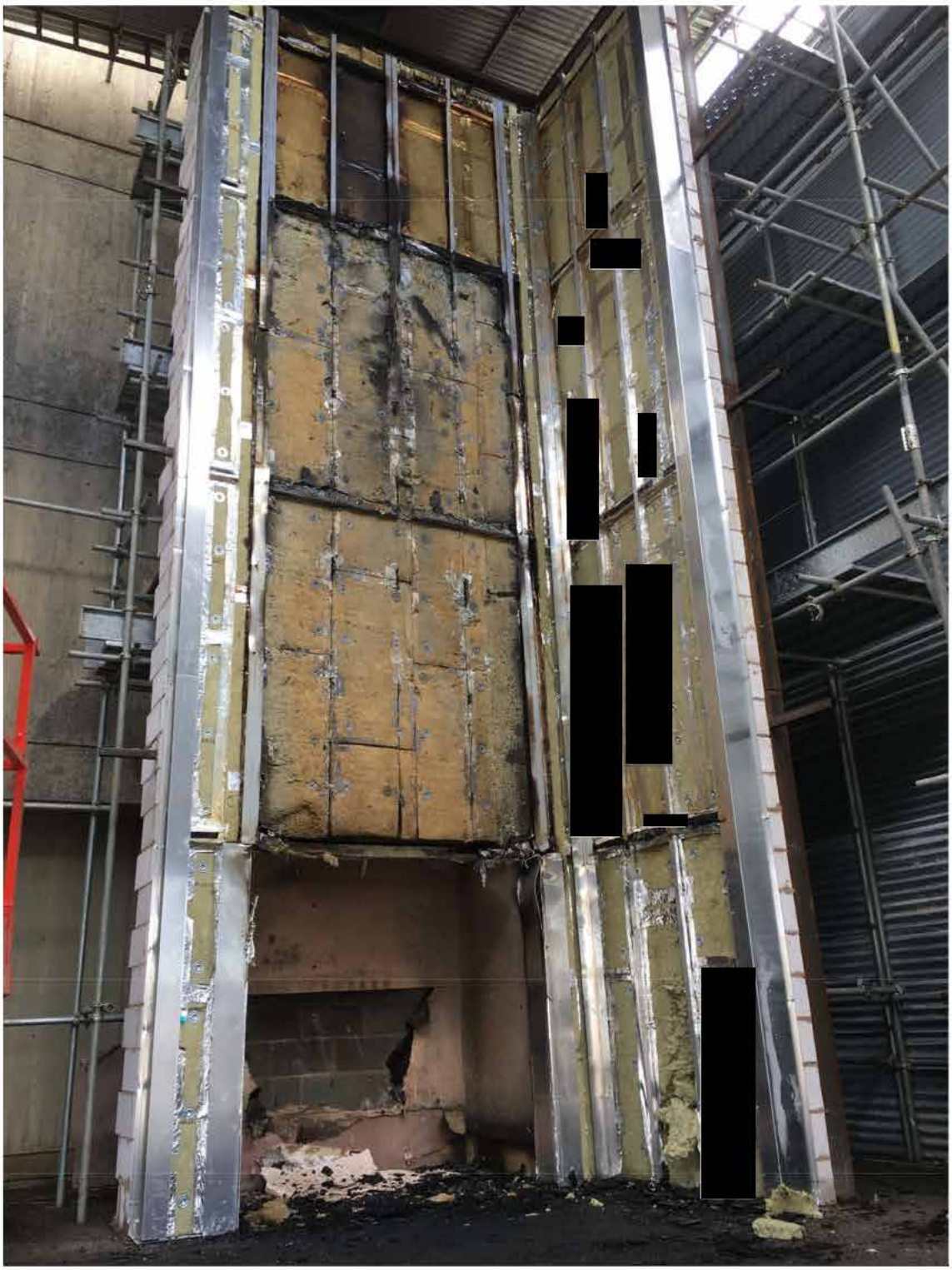


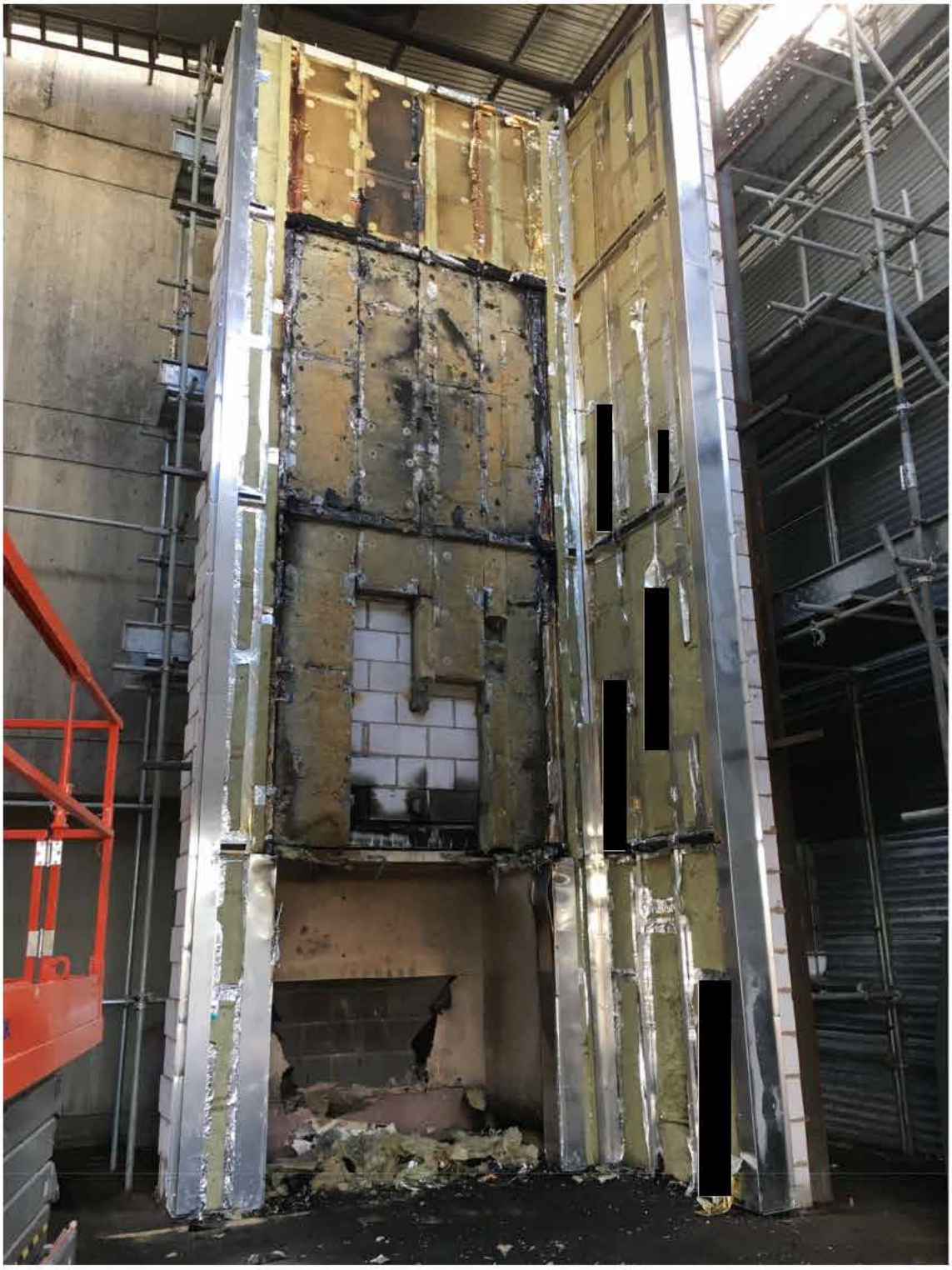
9 Appendix B – Installation process

10 Appendix C – Post-test photographs

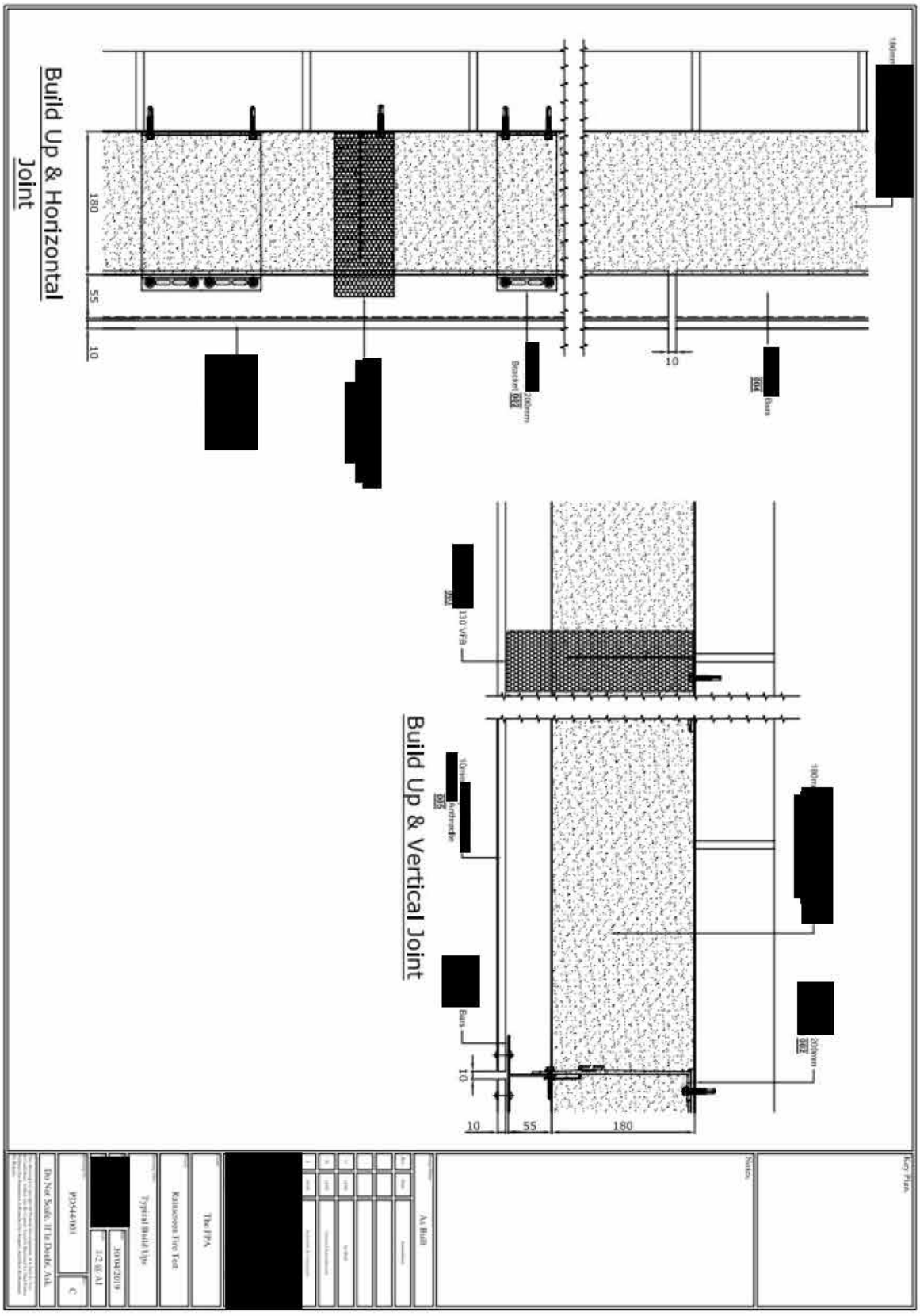


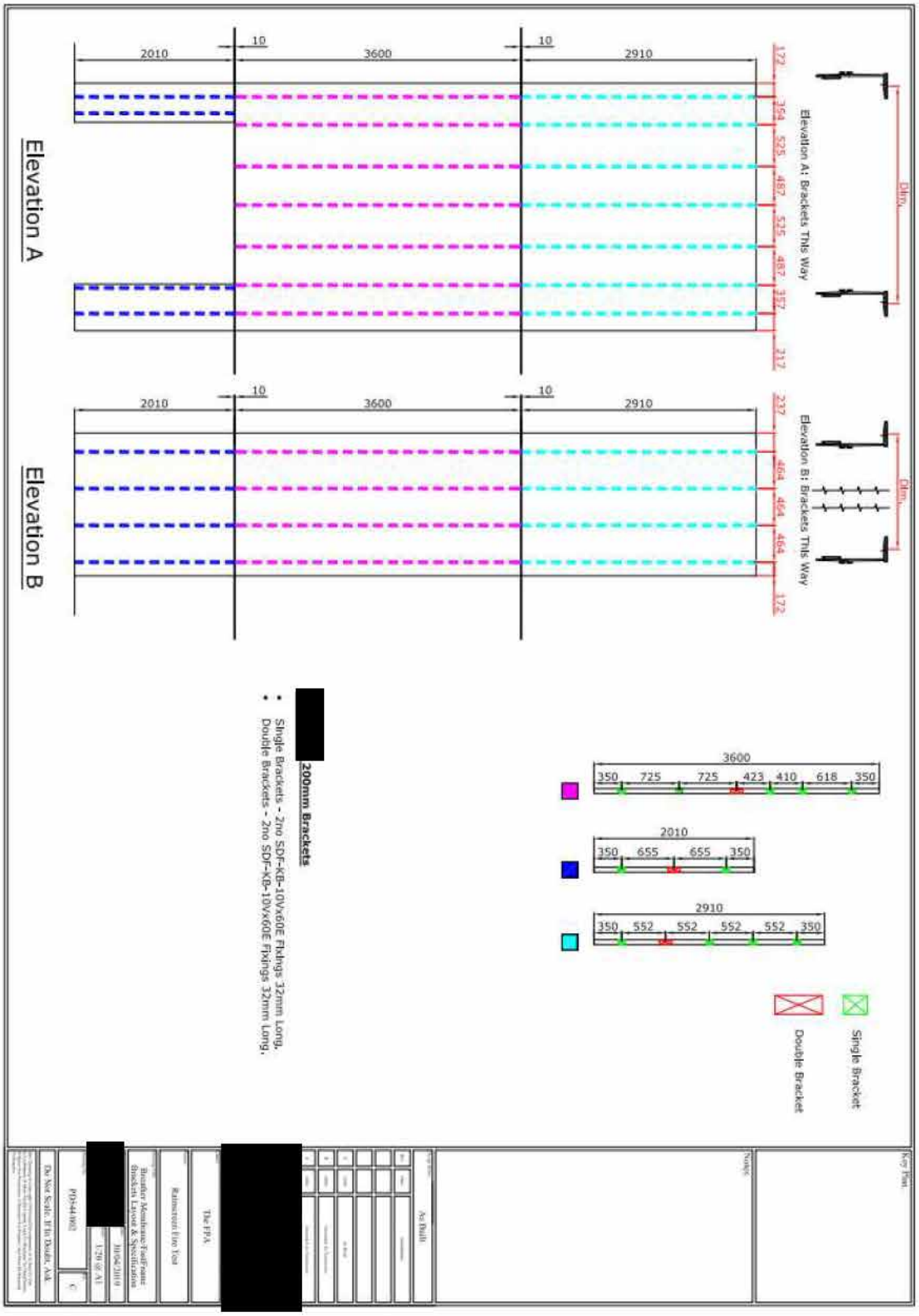


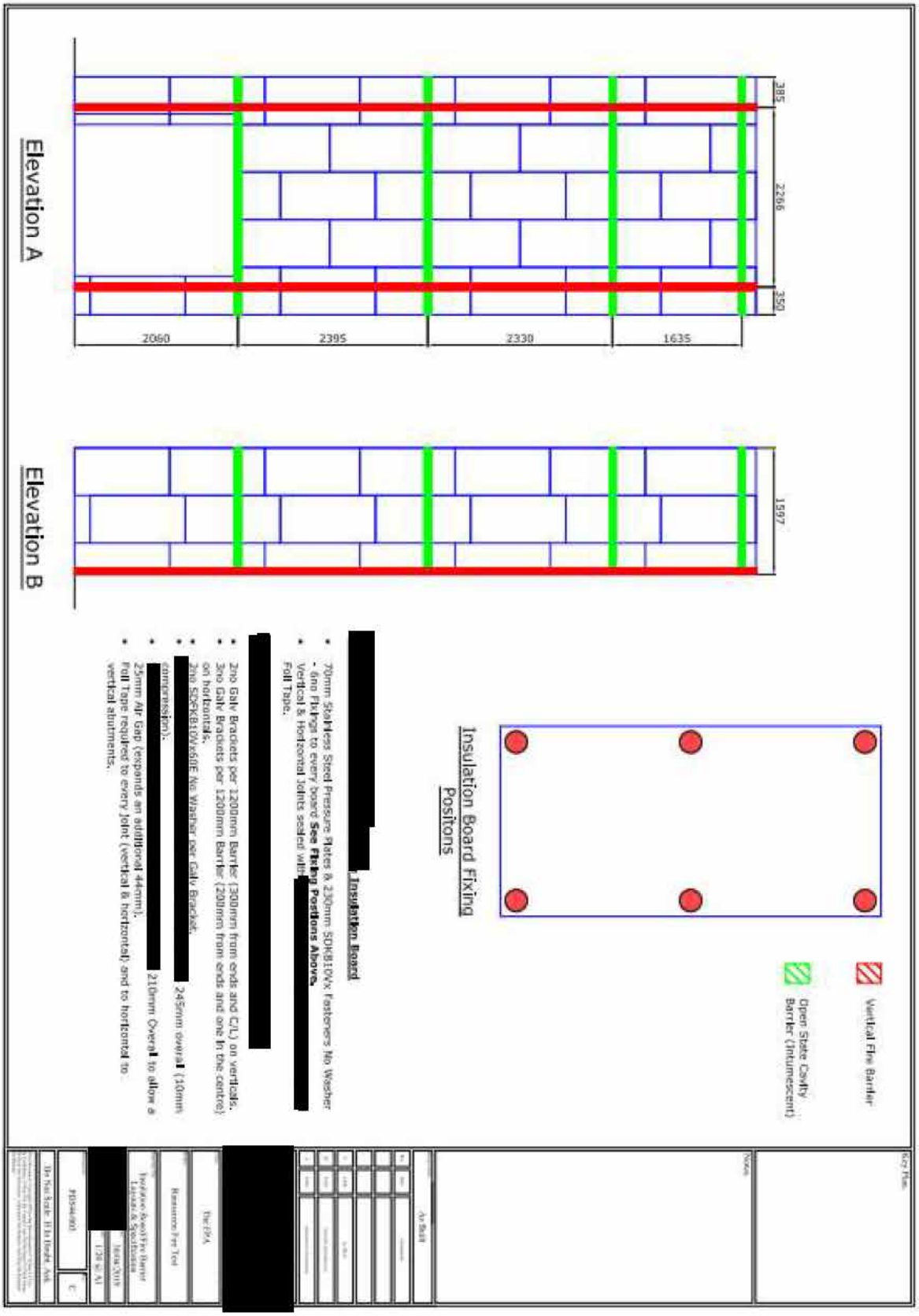


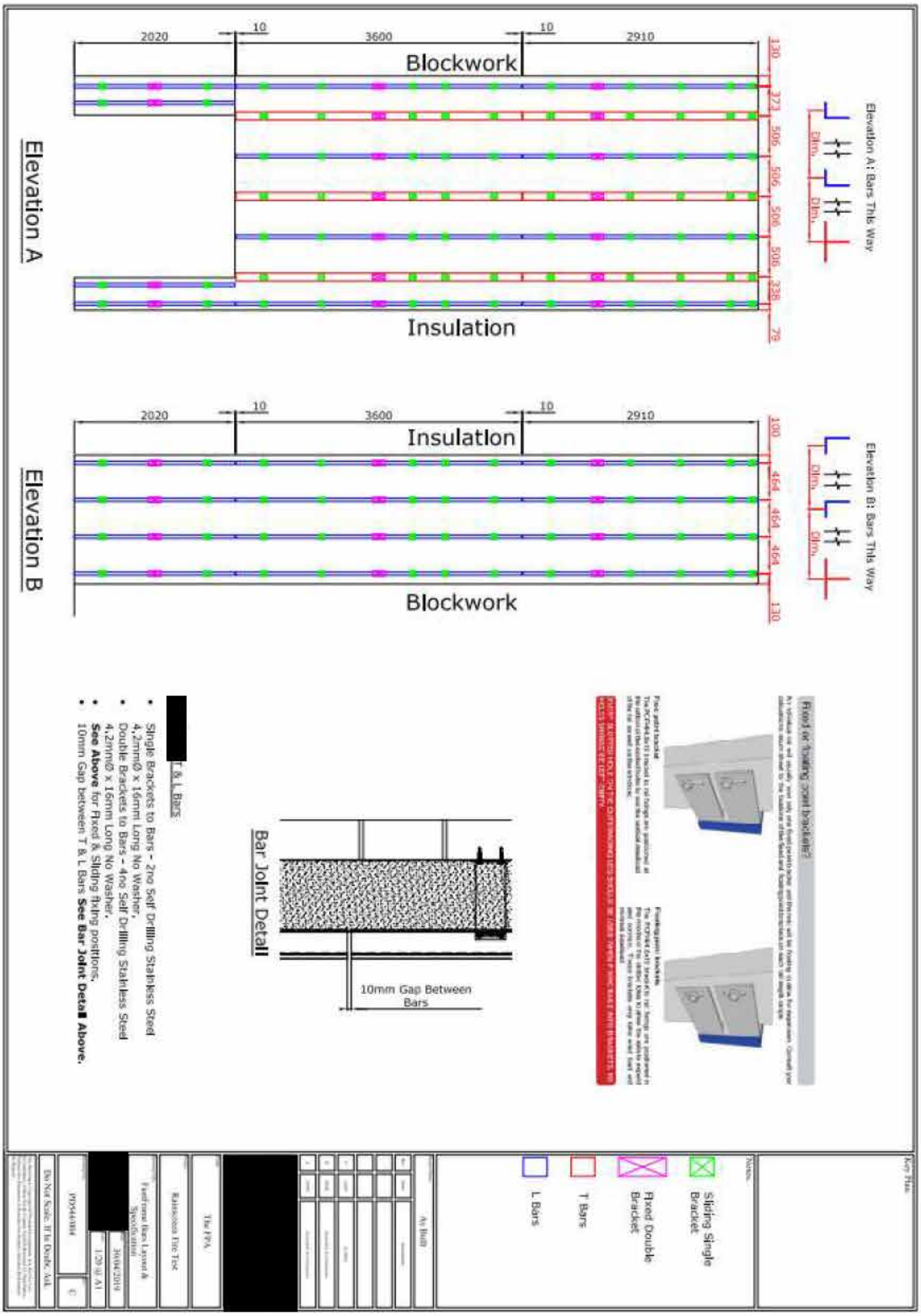


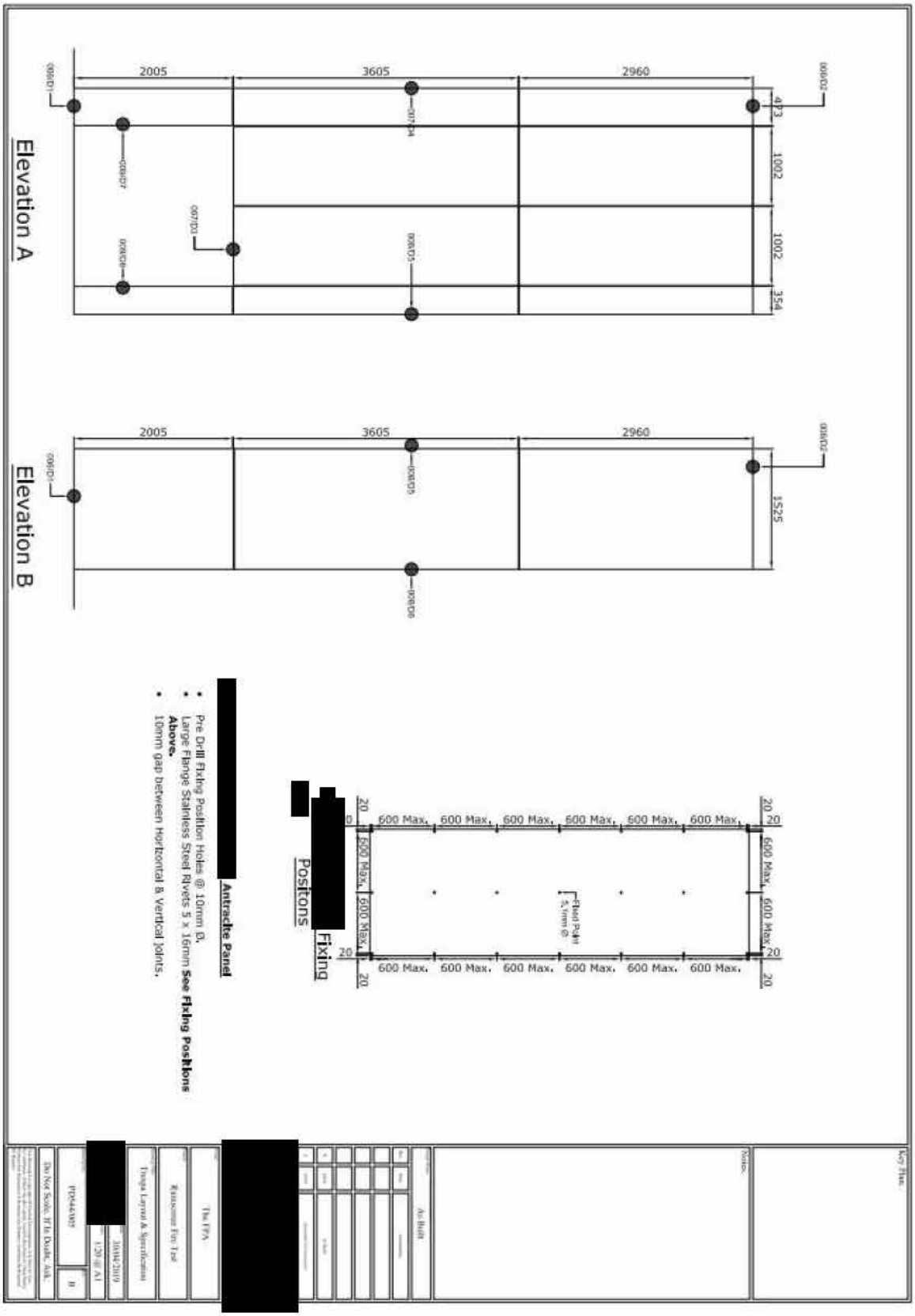
11 Appendix D – System Drawings

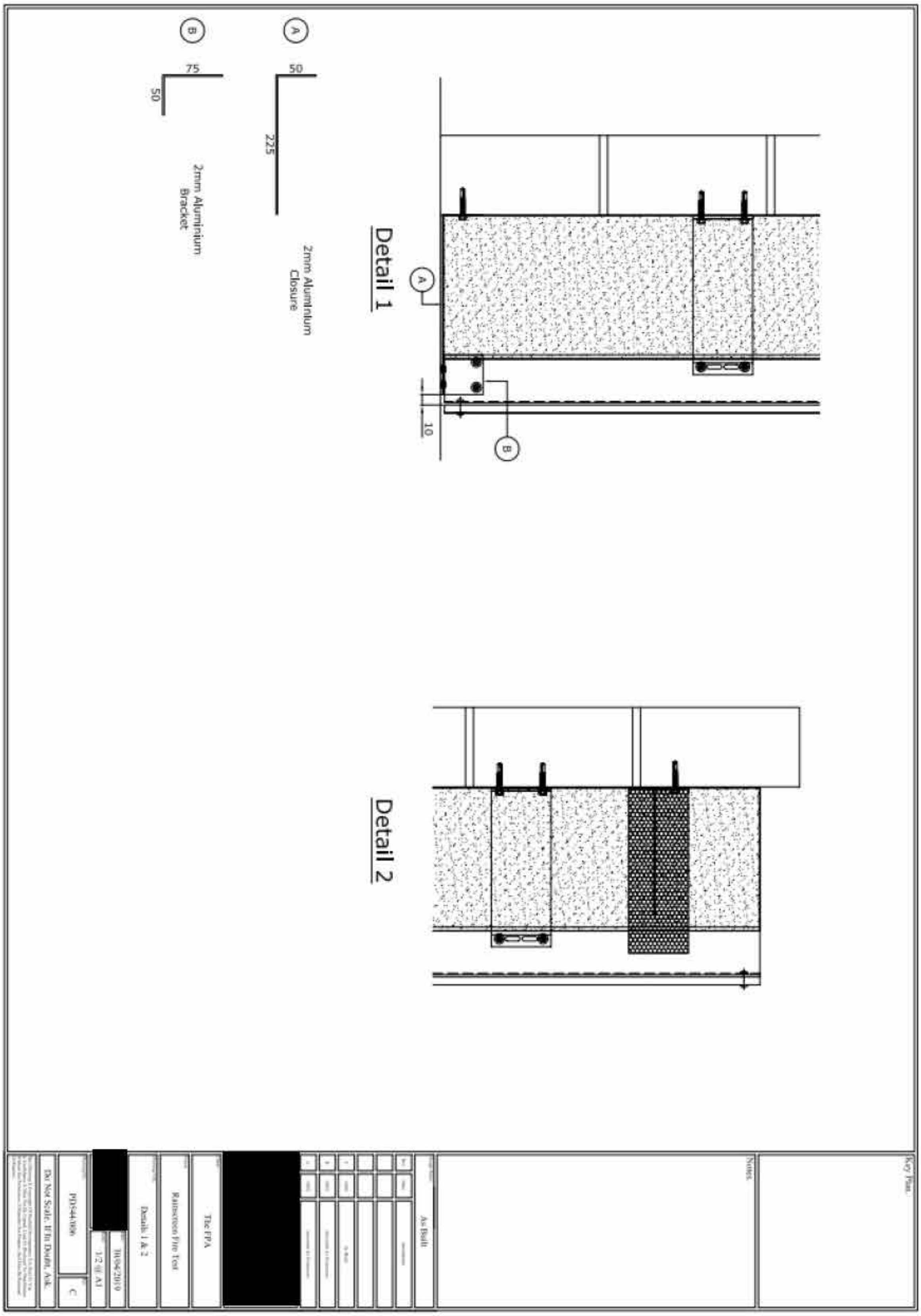


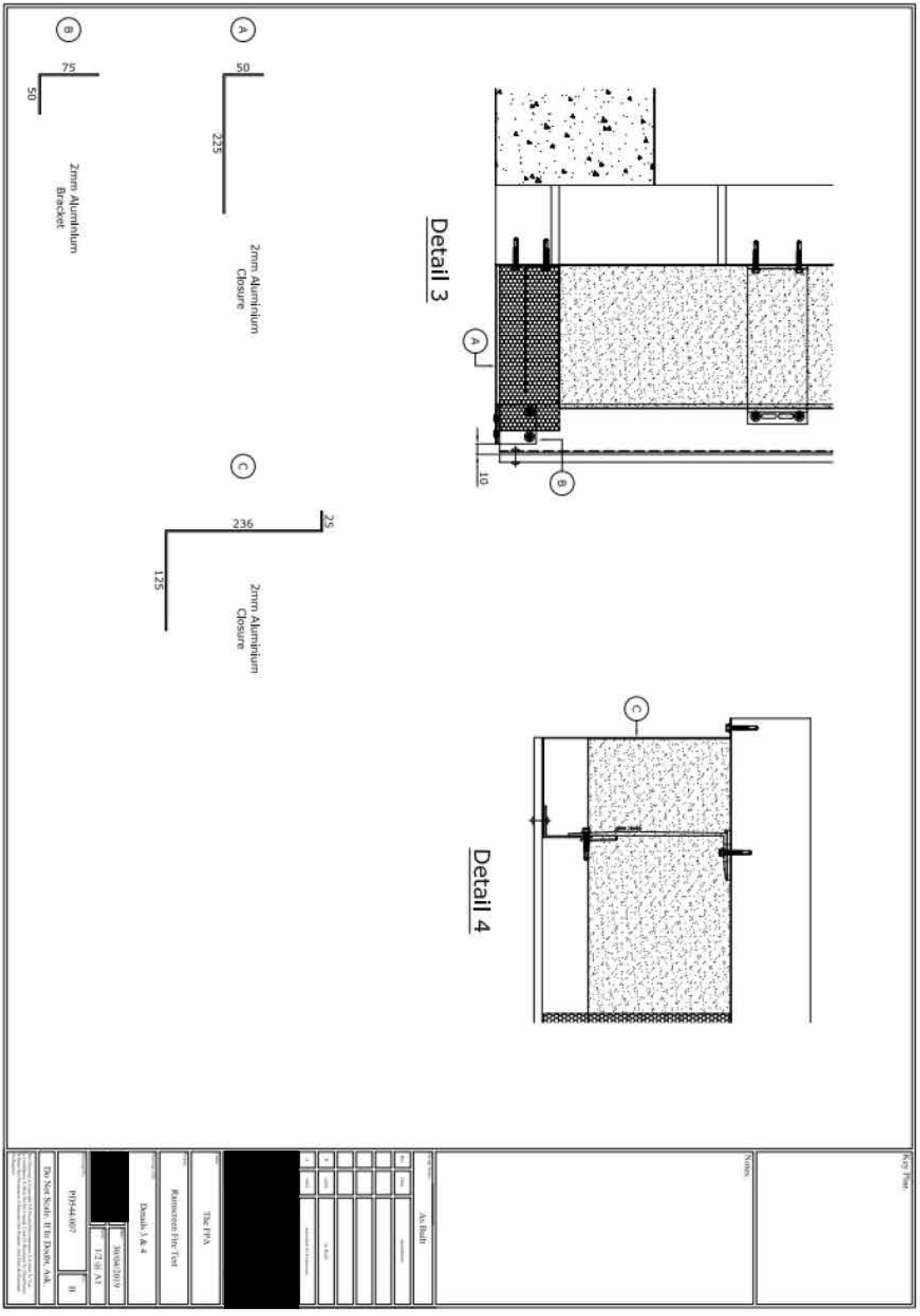

Elevation A
2010
10
3600
10
2910
172
354
525
487
525
487
357
217
Elevation A: Brackets This Way
Elevation B
237
464
464
464
172
Elevation B: Brackets This Way
200mm Brackets
Single Brackets - 2no SDF-KB-10Vx60E Fixings 32mm Long.
Double Brackets - 2no SDF-KB-10Vx60E Fixings 32mm Long.
3600
350 725 725 423 410 618 350
2010
350 655 655 350
2910
350 552 552 552 552 350
Double Bracket
Single Bracket

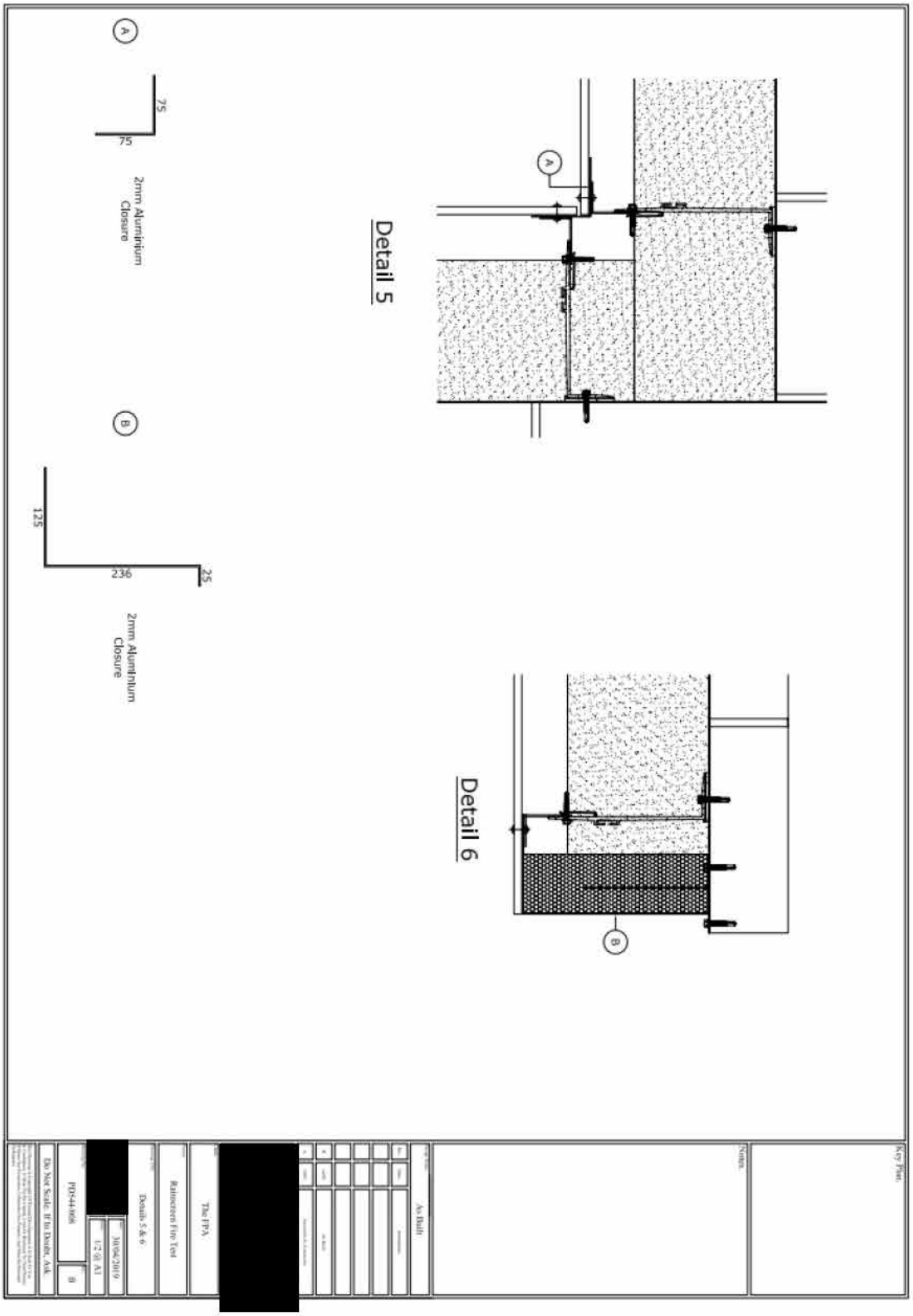

Elevation A
385
2266
350
2060
2395
2330
1635
Elevation B
1597
Insulation Board Fixing Positions
Vertical Fire Barrier
Open State Cavity Barrier (Intumescent)
Insulation Board
70mm Stainless Steel Pressure Rates & 230mm SDKB10Wx Fasteners No Washer - 6nn Fixings to every board See Fixing Positions Above.
Vertical & Horizontal Joints sealed with Foil Tape.
2no Gale Brackets per 1200mm Barrier (300mm from ends and C/L) on verticals.
3no Gale Brackets per 1200mm Barrier (200mm from ends and one in the centre) on horizontals.
2no SDKB10Vx60iE No Washer per Gale Bracket.
245mm overall (140mm compression).
210mm Overall to allow a 25mm Air Gap (expands an additional 44mm).
Foil Tape required to every joint (vertical & horizontal) and to horizontal to vertical abutments.
The FPA
Basement Fire Test
Notes

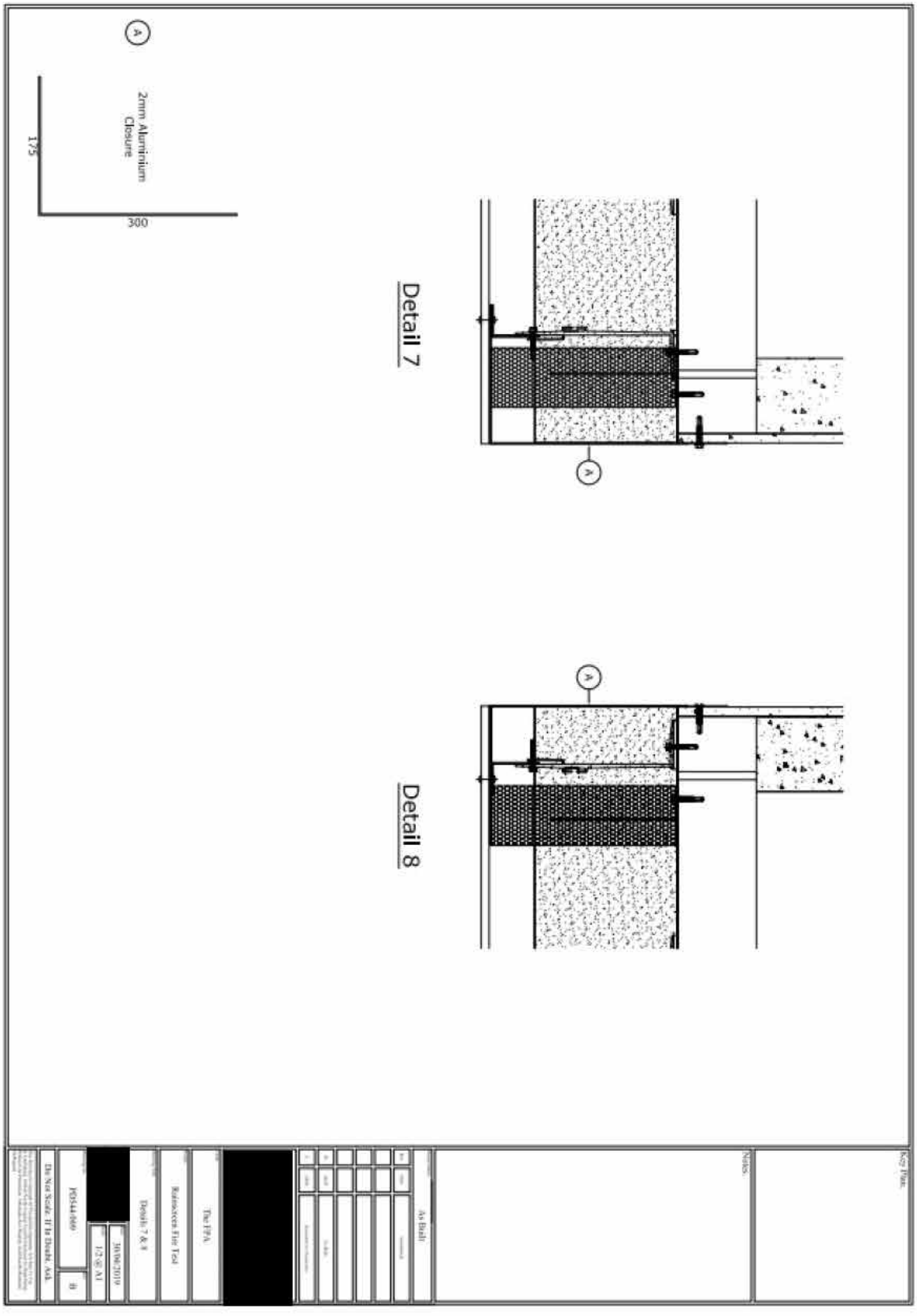

Elevation A
Blockwork
Insulation
2020
10
3600
2910
Elevation A: Bars This Way
Elevation B
Elevation B: Bars This Way
Bar Joint Detail
10mm Gap Between Bars
T & L Bars
Single Brackets to Bars - 2no Self Drilling Stainless Steel 4.2mmØ x 16mm Long No Washer.
Double Brackets to Bars - 4no Self Drilling Stainless Steel 4.2mmØ x 16mm Long No Washer.
See Above for Fixed & Sliding fixing positions.
10mm Gap between T & L Bars See Bar Joint Detail Above.
Fixed or floating joint brackets?
Sliding Single Bracket
Fixed Double Bracket
T Bars
L Bars
Do Not Scale. If In Doubt, Ask


Elevation A
2005
3605
2960
473
1002
1002
354
Elevation B
2005
3605
2960
1525
Antracite Panel
Pre Drill Fixing Position Holes @ 10mm Ø.
Large Flange Stainless Steel Rivets 5 x 16mm See Fixing Positions Above.
10mm gap between Horizontal & Vertical Joints.
Postions
Fixing
600 Max.
20
Fixed Pattern 5.1mm Ø


Detail 1
Detail 2
A
B
50
225
75
50
10
2mm Aluminium Closure
2mm Aluminium Bracket
Key Plan
Notes
As Built
[redacted]
The FPA
Rainscreen Fire Test
Details 1 & 2
[redacted]
1/2 @ A1
C
Do Not Scale. If In Doubt, Ask


B
75
50
2mm Aluminium Bracket
A
50
225
2mm Aluminium Closure
C
236
25
125
2mm Aluminium Closure
Detail 3
A
B
10
Detail 4
C
Roof Plan
Notes
As Built
The FPA
Reinstatement Fire Test
Details 3 & 4
Do Not Scale: If In Doubt, Ask.
PFP44-1007
III


A
75
75
2mm Aluminium Closure
B
125
236
25
2mm Aluminium Closure
Detail 5
A
Detail 6
B
Key Plan
Notes
As Built
The FPA
Rainscreen Fire Test
Details 5 & 6
30/04/2019
1:2 @ A3
P03-44-906
B
Do Not Scale. If In Doubt, Ask.


A
2mm Aluminium Closure
175
300
Detail 7
A
Detail 8
A
Do Not Scale. If in Doubt, Ask.
PES44-069
B
Details 7 & 8
Reinstatement Fire Test
The FPA
As Built
Notes:
Key Plan:

12 Appendix F - Equipment Calibration details

12.1 Time

Two timers were used during the test and data analysis, details of equipment used, and verification tests are as follows:

Procedure and reference equipment	
FPA procedure	MEOP-08: Management and use of chronometers, Version 1.0
Reference equipment	FPA's calibrated digital timer, Asset ID: 9004
Test equipment	
Stopwatch A	
Description	[redacted] digital timer
Asset tag ID	9031
Date of last verification test	13th June 2019
Stopwatch B	
Description	[redacted] digital timer
Asset tag ID	9032
Date of last verification test	13th June 2019
Stopwatch C	
Description	[redacted] digital timer
Asset tag ID	9034
Date of last verification test	13th June 2019

12.2 Distance

Measurements of length were taken using an EU Class 1 retractable tape measure, details as follows:

Procedure and test equipment	
FPA procedure	MEOP-07: Management and use of linear distance measuring devices, Version 2.0
Description of equipment	[redacted]
Asset tag ID	9002

12.3 Temperature

42 thermocouples were used in the test. Details of equipment used, and verification test conducted are as follows:

Procedure and reference equipment					
FPA procedure	MEOP-03: Management and use of thermocouples, Version 2.0				
Test equipment					
Datalogger	DT85, Asset ID: 9020				
Laptop	[redacted]				
Thermocouples	1.5mm type k mineral insulated thermocouples, Asset ID numbers: FPA TC0001 to FPA TC0036 *(TC Set FPA 8414-03)* FPA TC0S01 to FPA TC0S05 *(TC Set FPA SPARE-01)*				
Date of last verification tests	25th April 2019				
Thermocouple locations on test wall, see					
Test location	Asset ID	Test location	Asset ID	Test location	Asset ID
1A	FPA TC0001	5A	FPA TC0018	9	FPA TC0010
1B	FPA TC0002	5B	FPA TC0019	10	FPA TC0011
1C	FPA TC0003	5C	FPA TC0020	11	FPA TC0012
1D	FPA TC0S01	5D	FPA TC0S05	12	FPA TC0013
2A	FPA TC0004	6A	FPA TC0021	13	FPA TC0014
2B	FPA TC0005	6B	FPA TC0022	14	FPA TC0030
2C	FPA TC0006	6C	FPA TC0023	15	FPA TC0031
2D	FPA TC0S02	6D	FPA TC0033	16	FPA TC0032
3A	FPA TC0007	7A	FPA TC0024	17	FPA TC0037
3B	FPA TC0008	7B	FPA TC0025	18	FPA TC0036
3C	FPA TC0009	7C	FPA TC0026		
3D	FPA TC0S03	7D	FPA TC0034		
4A	FPA TC0015	8A	FPA TC0027		
4B	FPA TC0016	8B	FPA TC0028		
4C	FPA TC0017	8C	FPA TC0029		
4D	FPA TC0S04	8D	FPA TC0035		
Note(s): FPA TC0S01 Failed during the test and has been removed from service.					

12.4 Moisture Content

The fuel load moisture content was measured using a conductivity moisture meter for use with wood, details as follows:

Procedure and test equipment	
FPA procedure	MEOP-10: Management and use of wood moisture sensors, Version 1.0
Description of equipment	[redacted]
Asset tag ID	9005

12.5 Wind Speed Measurement

Wind speed was measured using a hot wire anemometer, details as follows:

Procedure and test equipment	
FPA procedure	MEOP-11: Management and use of anemometers, Version 1.0
Description of equipment	[redacted]
Asset tag ID	9001