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BRE Global Test Report

BS 8414-2:2015 + A1:2017 Test on Terracotta tile with Kingspan K15 insulation (80mm-thick)

Prepared for: **Kingspan Insulation Limited**

Report Number: **P119586-1000 Issue: 1**

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1 Introduction

The test method, BS8414-2:2015 + A1:2017[1] describes a method of assessing the behaviour of non-loadbearing external cladding systems, rainscreen over cladding systems and external wall insulation systems when applied to the face of a building and exposed to an external fire under controlled conditions. The fire exposure is 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.

All materials and products used in the test were supplied and installed by the Test Sponsor. BRE Global was not involved in sample selection or to witness manufacture of the components and therefore cannot comment upon the relationship between samples supplied for test and the samples supplied to market. Results apply to the sample as received and installed.

The validity of the results is conditional on the accuracy of the data. All measurements quoted in this report are nominal unless stated otherwise.

2 Details of Test Apparatus

The product was installed on to wall number 4 of the BRE Global test facility. This apparatus is representative of a structural steel framed building and consists of a structural steel test frame with a vertical main test wall and a vertical return wall at a 90º angle to and at one side of the main test wall - see *Figure* 41. The main wall includes the combustion chamber.

3 Description of the System

Product names, system drawings and other detailed construction data were supplied by the Test Sponsor and were not independently verified by BRE Global. The validity of the test results is conditional on the accuracy of the system details, the component specification and the installation of the system components.

The details in sections 3.1, 3.2 and 3.2.1 were dimensionally/visually verified and recorded during installation by BRE Global and take precedence over the Test Sponsor supplied drawings (section 3.2.2).

The Test Sponsor has been asked to review the test report and takes responsibility for any discrepancies and inaccuracies in the supplied drawings (section 3.2.2).

3.1 Summary

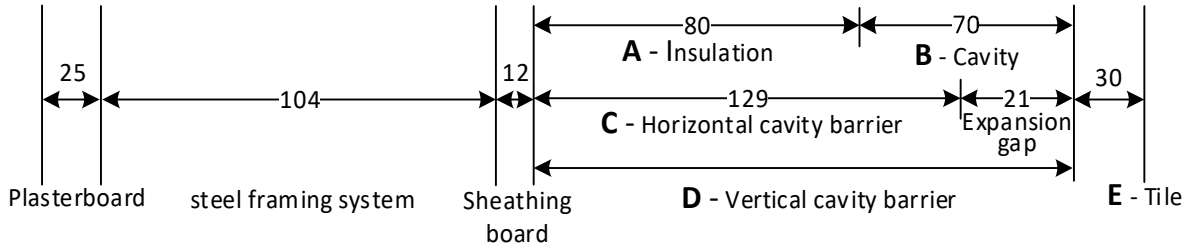

Figure 1. Basic system cross section (not drawn to scale, dimensions given in mm)

Generic cladding type	Terracotta tile rainscreen on a steel framing system
Insulation (A)*	Kingspan Kooltherm K15 (2400mm×1200mm×80mm-thick) Batch nr: 8100414380 dated 11-03-2021
Cavity (B)*	70mm
Horizontal (ventilated) cavity barriers (C)*	Siderise RH25G-090/030/154 open state cavity barrier with intumescent strip (75mm-high×129mm-deep with 25mm intumescent expansion)
Vertical (full fill) cavity barriers (D)*	Siderise RVG-090/030/154 cavity barrier (75mm-high×164mm-deep)
External finish (E)*	Taylor Maxwell Argeton GmbH Tampa Terracotta Tile platinum grey 10mm material thickness (263mm-high×492mm-wide×30mm-profile thickness)

* with reference to Figure 1

3.2 Description of product

Table 1. List of component parts used in the tested system.

Item	Description
1	Kingspan kingframe 'U'-shaped steel head track (104mm-deep×55mm-high×1.2mm-thick)
2	Steel base tracks: A. Kingspan King frame 'U'-shaped track (104mm-deep×55mm-high×1.2mm-thick) B. Hadley 'U'-shaped track (104mm-deep×40mm-high×1.2mm-thick)
3	Kingspan kingframe 'C'-shaped steel stud (100mm-deep×50mm-wide×1.2mm-thick, with 13mm return)
4	British Gypsum Gyproc Wallboard (2400mm×1200mm×12.5mm-thick)
5	Euroform Versapanel cement bonded particle board (2400mm×1200mm×12mm-thick)
6	Aluminium top-hat channel (190mm-high×85mm-deep×5mm-thick)
7	Kingspan Kooltherm K15 insulation (2400mm×1200mm×80mm-thick) Batch nr: 8100414380 dated 11-03-2021
8	Combustion chamber surround flashing, made from pre-welded aluminium angle: • Overall size: 2100mm-wide×2030mm-high • Angle size: 100mm-wide×183mm-deep×5mm-thick
9	Siderise RS350G split-end steel bracket (supplied as 350mm-deep×25mm-wide×1mm-thick, cut to 310mm-deep)
10	Siderise RH25G-090/030/154 open state cavity barrier with intumescent strip (75mm-high×129mm-deep, to suit void size 154mm)
11	Siderise B195G steel bracket (330mm-deep×25mm-wide×1mm-thick)
12	Siderise RVG-090/030/154 cavity barrier (75mm-high×164mm-deep, to suit void size 154mm)
13	Aluminium 'L'-shaped brackets: A. Single bracket (85mm-high×40mm-wide×40mm-deep×3mm-thick) B. Double bracket (160mm-high×40mm-wide×40mm-deep×3mm-thick)
14	Aluminium 'T'-shaped rails with two pre-drilled fixing locations 100mm apart at 250mm vertical centres (120mm-wide×45mm-deep×2mm-thick)
15	Aluminium 'L'-shaped angle (70mm-high×50mm-deep×2mm-thick)
16	Taylor Maxwell Argeton tile aluminium clips: A. Base clip (26mm-deep×43mm-high×22mm-wide×2.5mm-thick) – *see Figure 21* B. Double faced centre clip (26mm-deep×63mm-high×22mm-wide×2.5mm-thick) – *see Figure 24* C. Top clip: continuous rail (25mm-deep×40mm-high×15mm-return×2mm-thick) – *see Figure 30*
17	Profiled aluminium drainage rails: A. 60mm-wide×20mm-deep×1mm-thick – *see Figure 26* B. 46mm-wide×14mm-deep×0.5mm-thick – *see Figure 27*
18	Taylor Maxwell Argeton GmbH Tampa Terracotta Tile platinum grey 10mm material thickness (263mm-high×492mm-wide×30mm-profile thickness) – *see Figure 28*

19	Top of system capping: A. Profiled steel bracket (280mm×72mm-high×3mm-thick) – *see Figure 32* B. 'U'-shaped aluminum capping (350mm-deep×40mm/35mm-high front/rear×3mm-thick) – *see Figure 34*

3.2.1 Installation sequence

Figure 2. Structural steel frame.

200mm×200mm×6mm Square Hollow Section (SHS) steel beams were fitted as part of the BRE test rig at 2530mm, 5070mm and 7550mm from ground to underside of section. At the top of the apparatus was a further SHS 150mm-high×100mm-deep, 9030mm from ground to underside. These were the primary attachment points of the cladding system to the test rig.

Figure 3. Full-height installation of the steel framing system and plasterboard.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Figure 4. Base track oversailing SHS.

Head tracks (Item 1) were fixed to the underside of the SHS beams, with Evolution SuperTek 7 TSBW5.5-50-7 (5.5mm×50mm) self-drilling screws with EDPM washers at nominal 600mm horizontal centres.

A mixture of base tracks (Item 2A & 2B) were fixed to the ground and top side of the SHS beams, with FixFast HTF-6.3mm×70mm screws to ground and Evolution SuperTek 7 TSBW5.5-50-7 (5.5mm×50mm) self-drilling screws with EDPM washers to the SHS at nominal 600mm horizontal centres.

Vertical studs (Item 3) were fixed between the base and head tracks with FixFast DFS-CF-5.5mm×22mm screws, one screw at top and base of stud to front face only. Nominal stud centres were at 600mm horizontally with reduced centres at edge of walls. The Steel Framing System (SFS) oversailed the SHS beams by nominal 10mm.

Two layers of plasterboard (Item 4) were fixed to the rear of the system with FixFast DF3-SSA4-W-4.8mm×40mm stainless steel screws at nominal 300mm vertical centres. Both layers of plasterboard were installed with long edge vertical – joints were staggered.

Figure 5. Installation of top of system detail.

Head track (Item 1) was fixed at the top of the system to the top face of the SHS (9180mm from ground), with Evolution SuperTek 7 TSBW5.5-50-7 (5.5mm×50mm) screws with EDPM washers. A second head track was fixed on top with FixFast DFS-CF 5.5mm×22mm screws. All fixing centres at nominal 600mm horizontally.

Figure 6. Full-height installation of the sheathing board.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Figure 7. Double layer of sheathing board at combustion chamber surround.

A single layer of cement particle board (Item 5) was fixed to the front face of the SFS. An additional layer of board (Item 5) was packed into the approx. 10mm cavity that formed where the first layer overlapped the blockwork at the front face of the combustion chamber. The boards were fixed to the SFS. On the main wall, the boards were cut to size where required (combustion chamber and at wing wall junction) and installed with long edge vertical (except directly above the combustion chamber). Board joints were not staggered. Fixed with FixFast DF3-SSA4-W-4.8mm×40mm screws at nominal 300mm vertical centres. Board joints were 5mm nominal width and were sealed with Everbuild Everflex Fire Mate intumescent sealant.

On the wing wall, the boards were cut to size and installed with long edge horizontal.

Figure 8. Installation of the top-hat channel and combustion chamber flashing.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

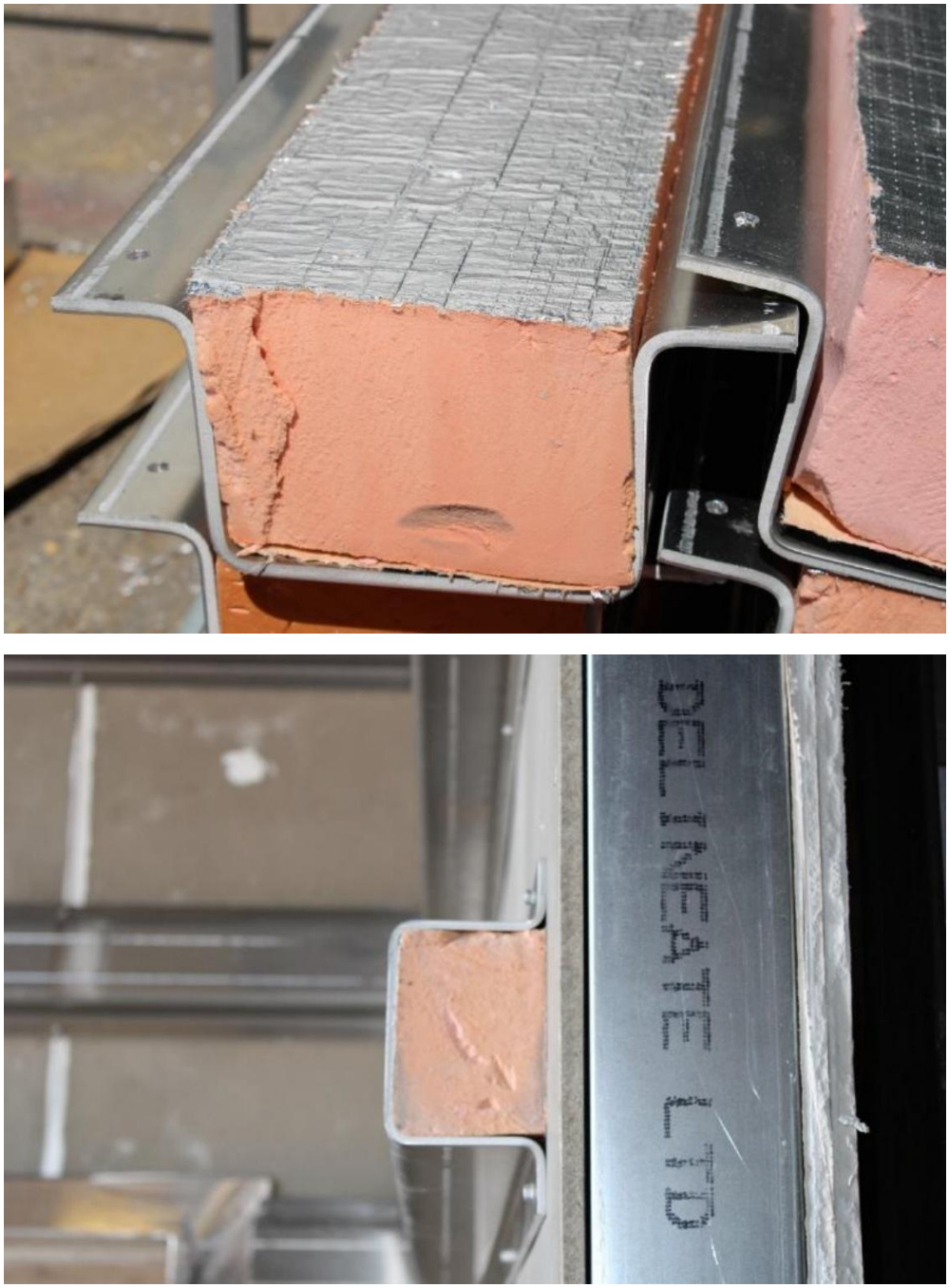

Figure 9. Top-hat channel filled with insulation.

Top-hat channels (Item 6) were infilled with 110mm-high×80mm-thick insulation sections (Item 7) and fixed to the system with FixFast DF3-SS-5.5mm×50mm screws, at nominal 600mm horizontal centres (reduced to 300mm towards edge of walls), through top and bottom flange of channel. 12 rows of channels (Item 6) were installed across full system height at 430mm-810mm vertical centres.

Figure 10. Installation of combustion chamber flashing.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Aluminium flashing (Item 8) was fixed flush to the combustion chamber opening face, with Fischer SXR 10mm×60mm FUS A4 screws with plastics anchors, at approximately 480mm centres. Everbuild Everflex Fire Mate intumescent sealant was applied to flashing and combustion chamber joint.

Figure 11. Installation of horizontal and vertical cavity barriers.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Figure 12. Horizontal and vertical cavity barrier joints.

Steel split-end brackets (Item 9) were cut to 310mm, folded to 140mm-deep and fixed in three full-width rows located at: 3200mm, 6190mm and 9260mm from ground to centre of barrier. Another row was located at: 2180mm from ground in line with the combustion chamber opening width (2100mm). The brackets were fixed above the barrier location (except at the top of the system) at 400mm horizontal centres with one FixFast DF3-SS-5.5mm×50mm screws.

Horizontal cavity barriers (Item 10) were pressed onto the split-end brackets so that the brackets protruded. The tip of the bracket was trimmed and the split-ends folded back to secure the barrier in place. Aluminium tape was applied to the barrier joints at top and bottom faces in line with the foil face.

Steel brackets (Item 11) were folded to 140mm-deep and fixed in two continuous columns located at: 2950mm (main wall) and 1630mm (wing wall) from the sheathing board face at the main-wing wall junction to centre of barrier. An additional two columns were installed either side of the combustion chamber at: 335mm and 2520mm from the wing wall sheathing board to a height of 2230mm. The brackets were fixed at 600mm vertical centres with one FixFast DF3-SS-5.5mm×50mm screws.

Vertical cavity barriers (Item 12) were pressed onto the brackets in columns. Aluminium tape was applied: at vertical barrier-horizontal barrier joints (top and bottom face of horizontal barrier) and vertical barrier-barrier joints (side faces).

Figure 13. Installation of insulation.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Figure 14. Insulation fixing washers and screw.

Insulation boards (Item 7) were cut to size and installed between the top-hat channels. Insulation boards were fixed with FixFast SF-T-75×25mm plastic tube washers and FixFast SF-P-SS-70-D pressure plates with FixFast DF3-SS-HT-A15-5.5mm×130mm screws. The vertical centres of fixings were nominally at 500mm and the horizontal centres varied depending on the board sizes but were measured to be between 400mm-1000mm. Aluminum tape was applied: over the fixings, at insulation to top-hat channel joints and at insulation to cavity barrier joints.

Figure 15. Installation of brackets.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

Figure 16. Single bracket.

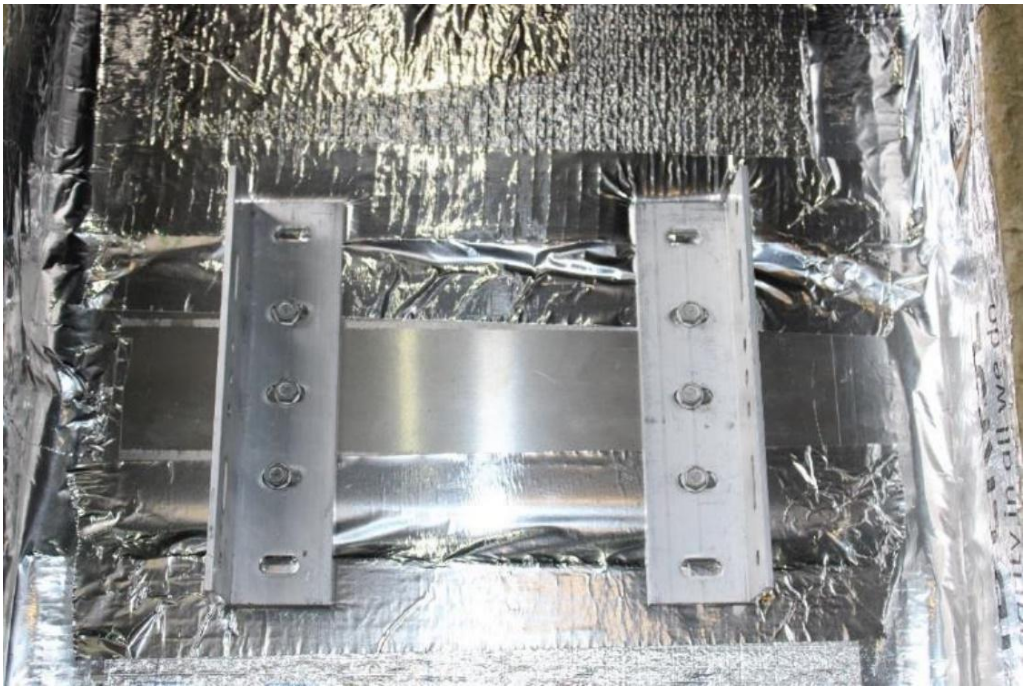

Figure 17. Double bracket.

Aluminium brackets (Item 13A & 13B) were fixed to the top-hat channels with FixFast DF3-SS-5.5×35mm screws, two per single bracket and three per double bracket. Horizontal bracket centres were measured at 492mm and reduced to 195mm at the combustion chamber sides.

Double brackets were used at locations where two rails adjoined: approx. every 3.5m, reduced to approx. 1m between the first two rows.

Figure 18. Installation of ‘T’-shaped rails.

Note: 100mm-thick blockwork skin to right side of combustion chamber opening was fully removed prior to test.

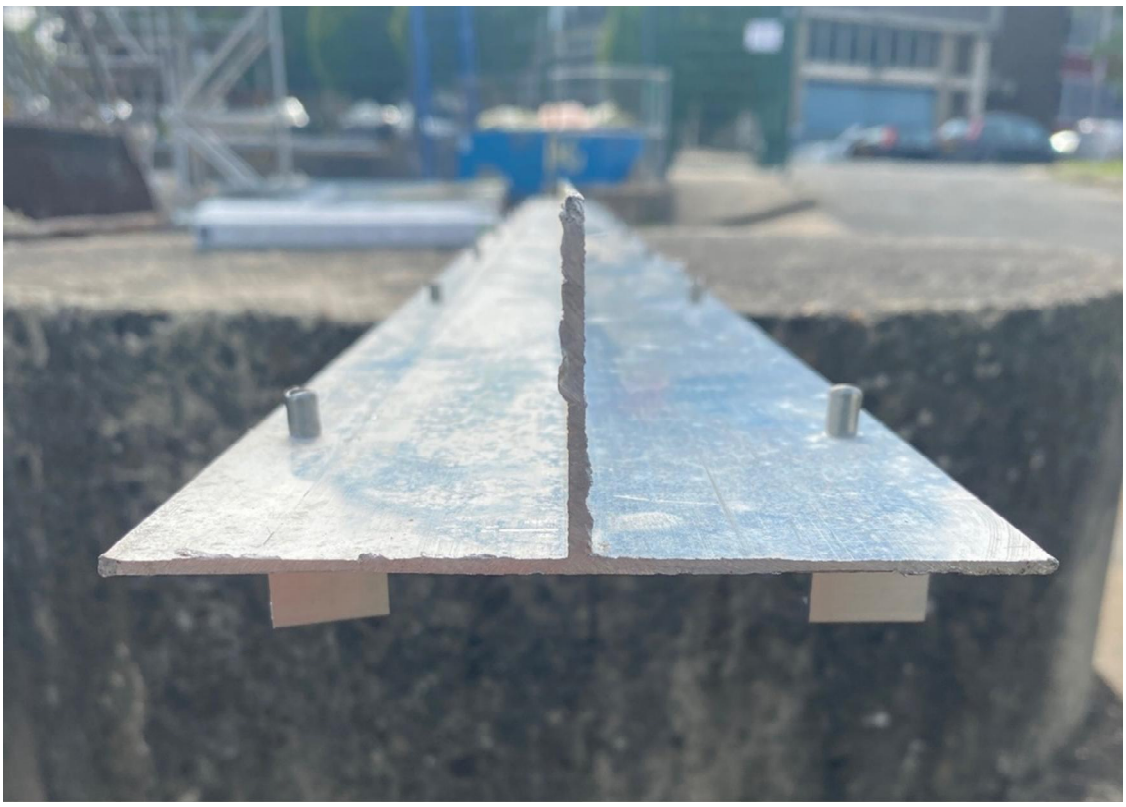

Figure 19. ‘T’-shaped rail.

Aluminium rails (Item 14) were fixed to the brackets with FixFast DF3-SS-CF-4.8mm×25mm screws, two fixings per single bracket and three fixings per double bracket. The face of the rails had pre-existing fixing holes on front face, 250mm vertical centres×100mm horizontal centres.

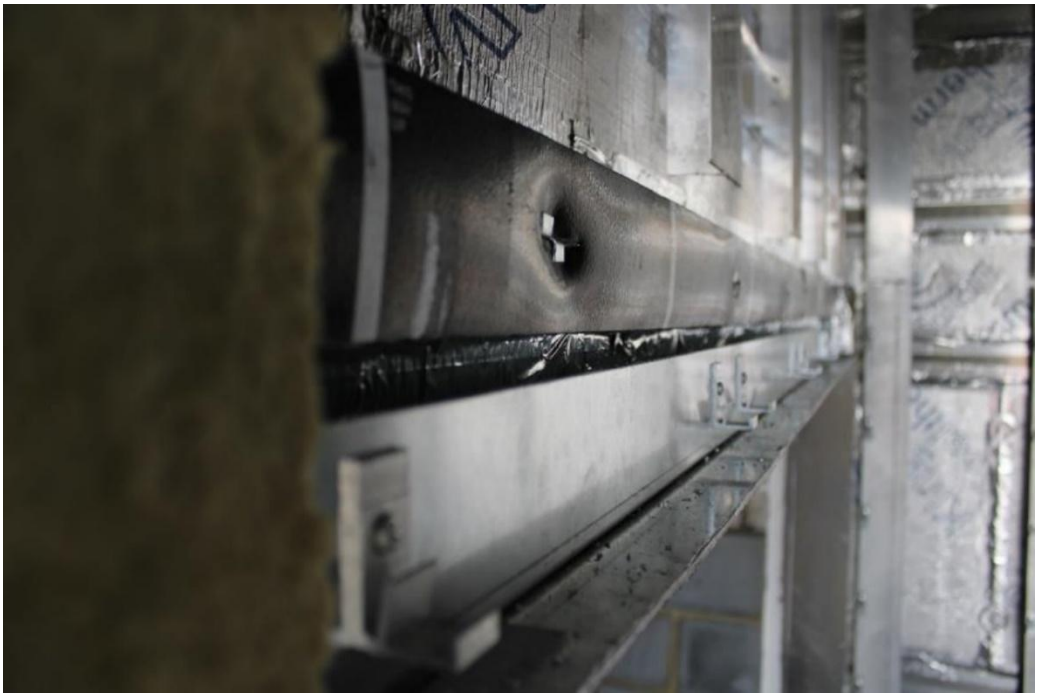

Figure 20. 'L'-shaped angle fixed to combustion chamber flashing top edge.

Aluminium angle (Item 15) was fixed to the top side of the combustion chamber surround, 40mm short of front face with FixFast DF3-SS-5.5×35mm screws at nominal 500mm horizontal centres.

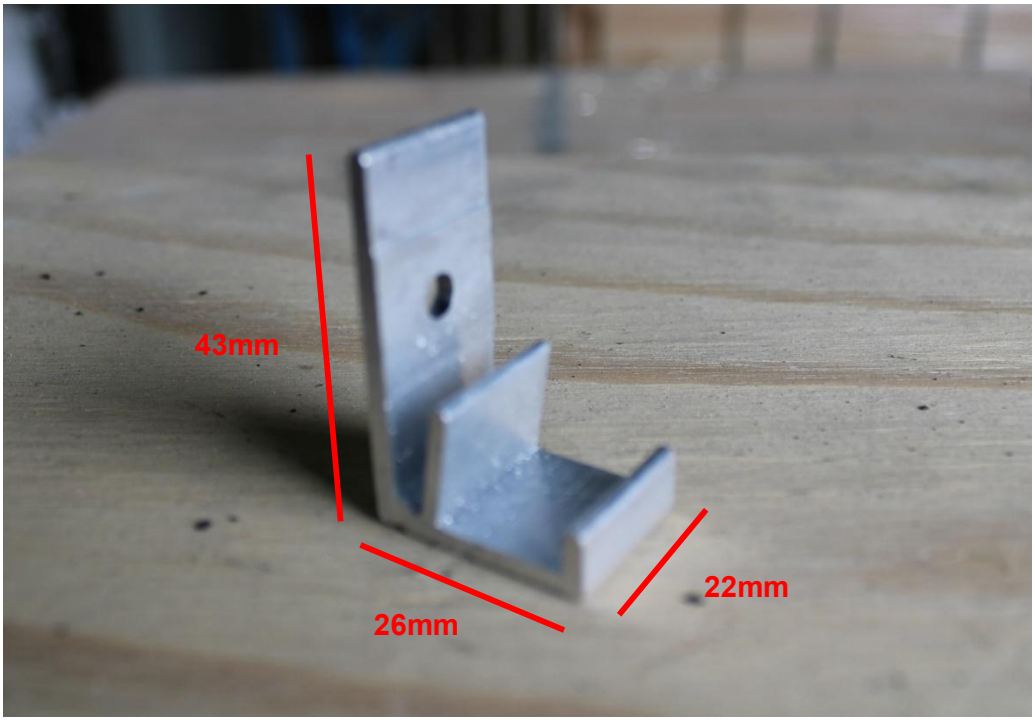

Figure 21. Base tile clip (Item 16A).

Figure 22. Base tile clip fixed to angle.

Base clips (Item 16A) were fixed to the angle located above the combustion chamber surround flashing, with FixFast DF3-SS-CF-4.8mm×25mm screws, two per location 100mm apart. Clips were in line with rail locations.

Figure 23. Base tile clip fixed to rails

Base clips (Item 16A) were fixed to 'T'-shaped rails at ground level only, approx. 45mm from ground. Clips were fixed with FixFast R-SS-LF-4.8×16mm rivets, two per location 100mm horizontal centres (pre-existing fixing location).

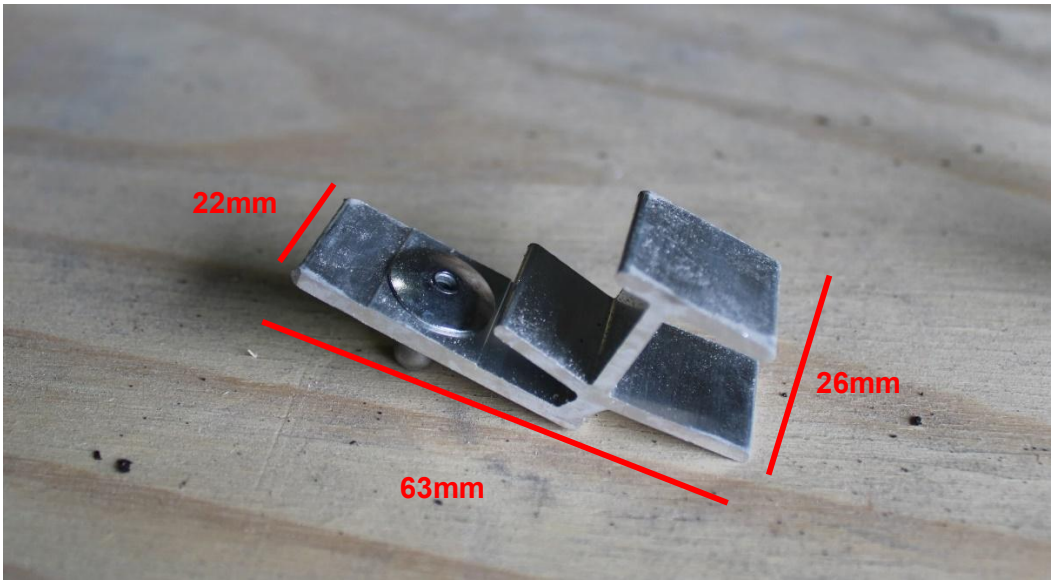

Figure 24. Centre double clip (Item 16B).

Figure 25. Centre double clip fixed to rail.

Double faced centre clips (Item 16B) were fixed to the ‘T’-shaped rails at 250mm vertical centres from the base clips, two per location, 100mm horizontal centres (pre-existing fixing location).

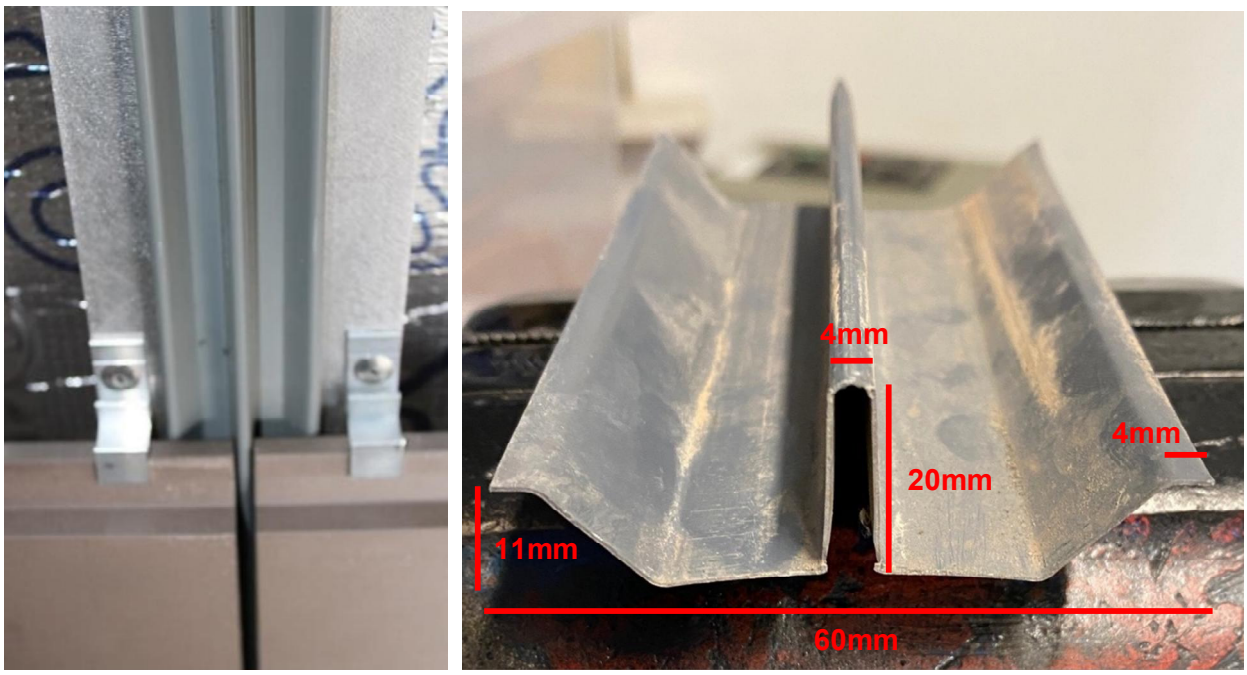

Figure 26. Drainage rail.

Drainage rails (Item 17A) were placed against the face of the ‘T’-shaped rails in line with the vertical tile joints.

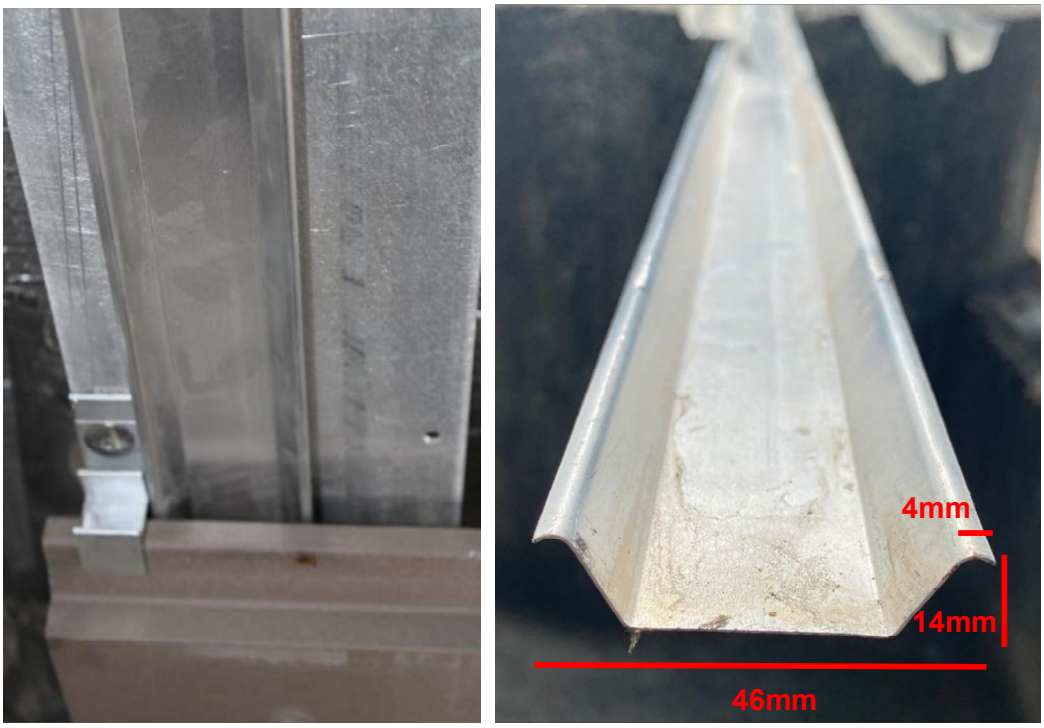

Figure 27. Drainage rail

Drainage rails (Item 17B) were placed against the face of the ‘T’-shaped rails at the edge of walls and combustion chamber opening sides.

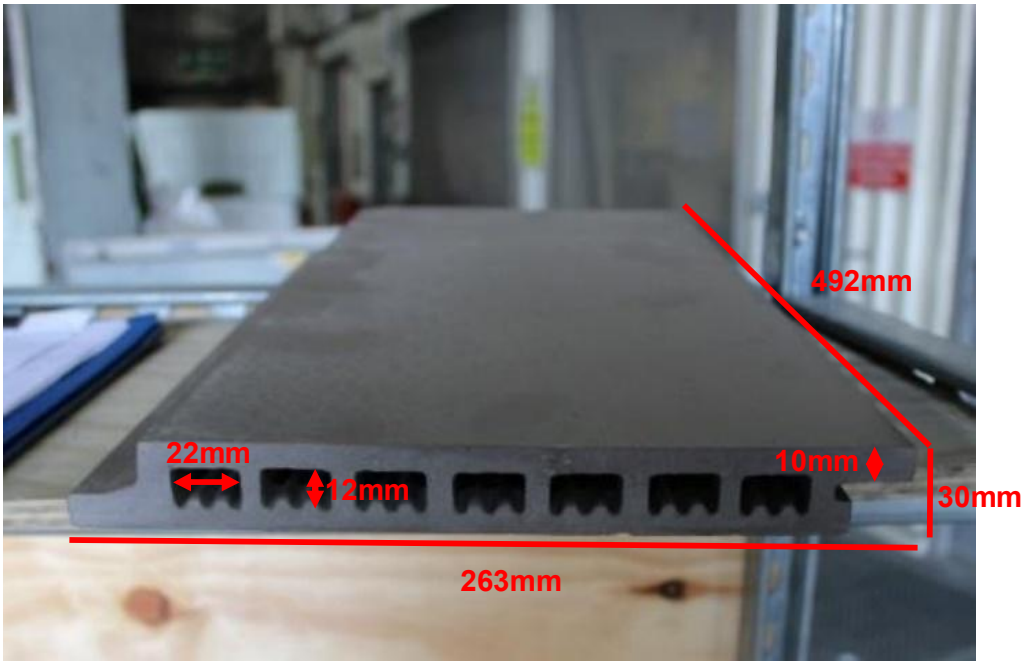

Figure 28. Tile profile.

Figure 29. Installation of tiles.

The first row of tiles (Item 18) were hooked onto the base clips at the base of system, with the top of tiles secured with the centre clips. The next row of tiles were placed onto the centres clips and secured with centre clips at top of tiles, this process was continued to the penultimate row at top of system. The final row of tiles were secured at the top edge using a continuous top clip rail (see Figures 27-29). Panel gaps were measured to be 4mm at vertical joints and 13mm at horizontal joints.

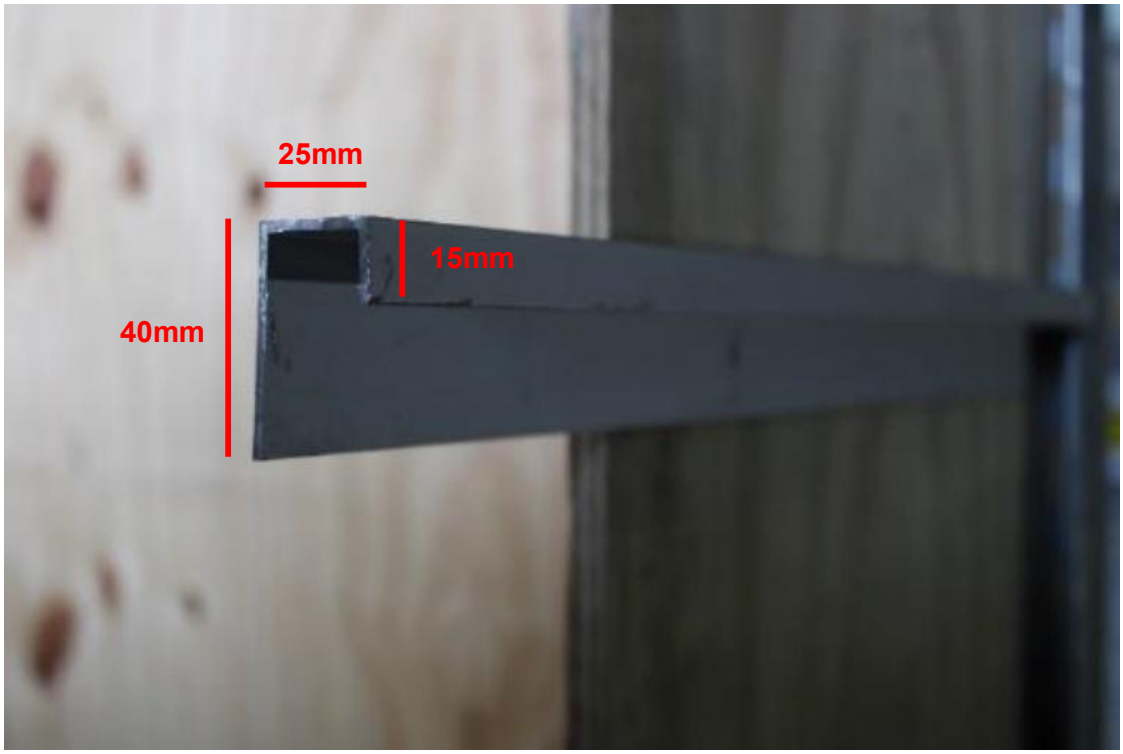

Figure 30. Top clip – continuous rail (Item 16C).

Figure 31. Example of top clip placed at the top of tile.

Figure 32. Top of system detail – profiled bracket (Item 19A)

Figure 33. Top of system detail - profiled bracket and continuous top clip.

The top clip (Item 16C) was fixed to the front face of profiled bracket (Item 19A) with one FixFast DF3-SS-CF4.8mm×25mm screws per bracket. The top clip was positioned to line up with the top edge of the tiles.

The profiled brackets (Item 19A) were fixed to the SFS head track at the top of system (See Figure 4), with two FixFast DF3-SS-CF4.8mm×25mm screws per bracket. The centre of brackets were installed at nominal 1000mm horizontal centres.

Figure 34. Top of system capping

Aluminium capping (Item 19B) was fixed to the profiled brackets (Item 19A) with the 40mm-high edge facing the exposed system face. The item was fixed with FixFast DF3-SS-CF4.8mm×25mm screws, two screws per location, 200mm apart.

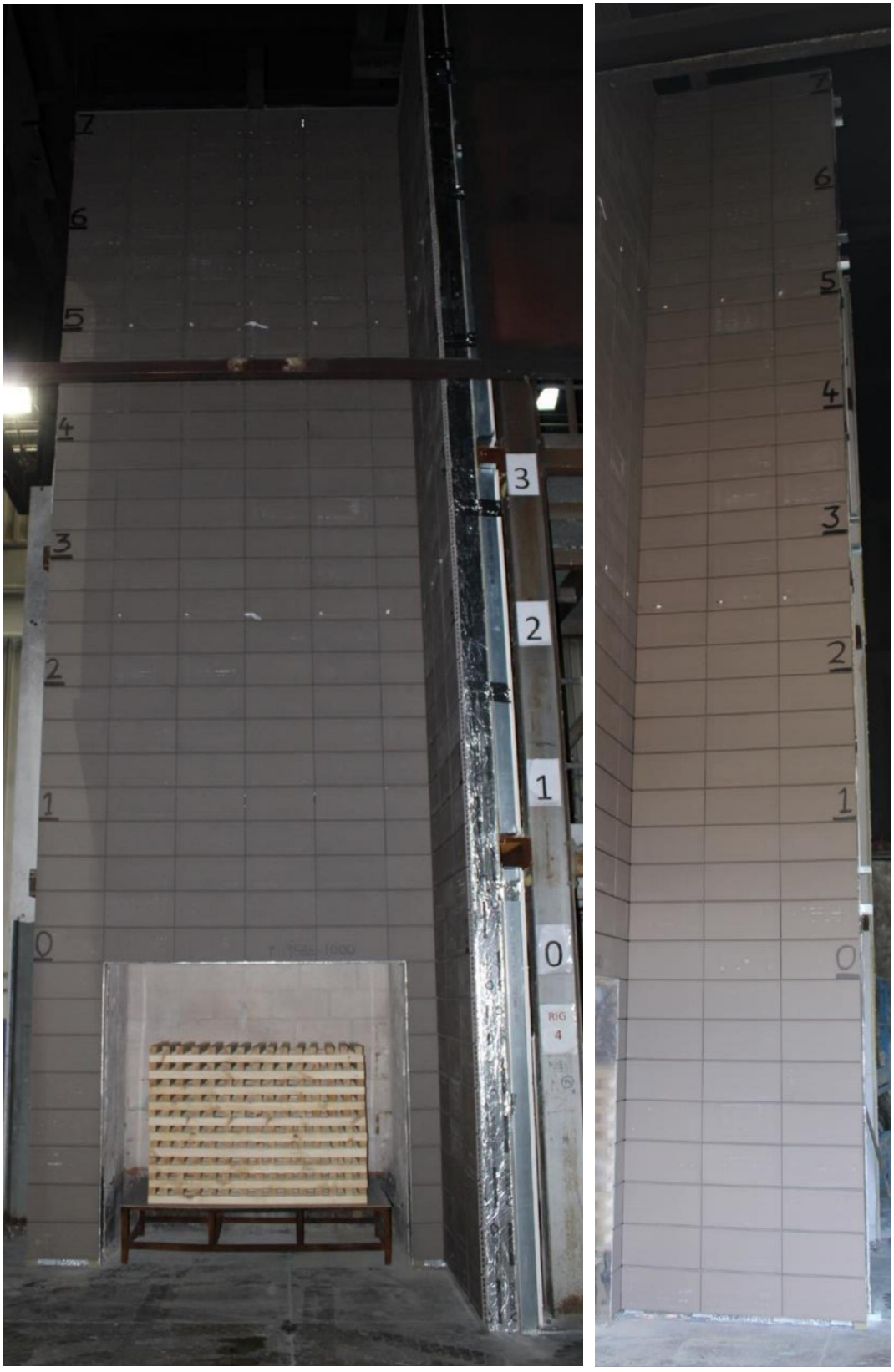

Figure 35. Full-height photograph of completed installation prior to testing.

3.2.2 System drawings

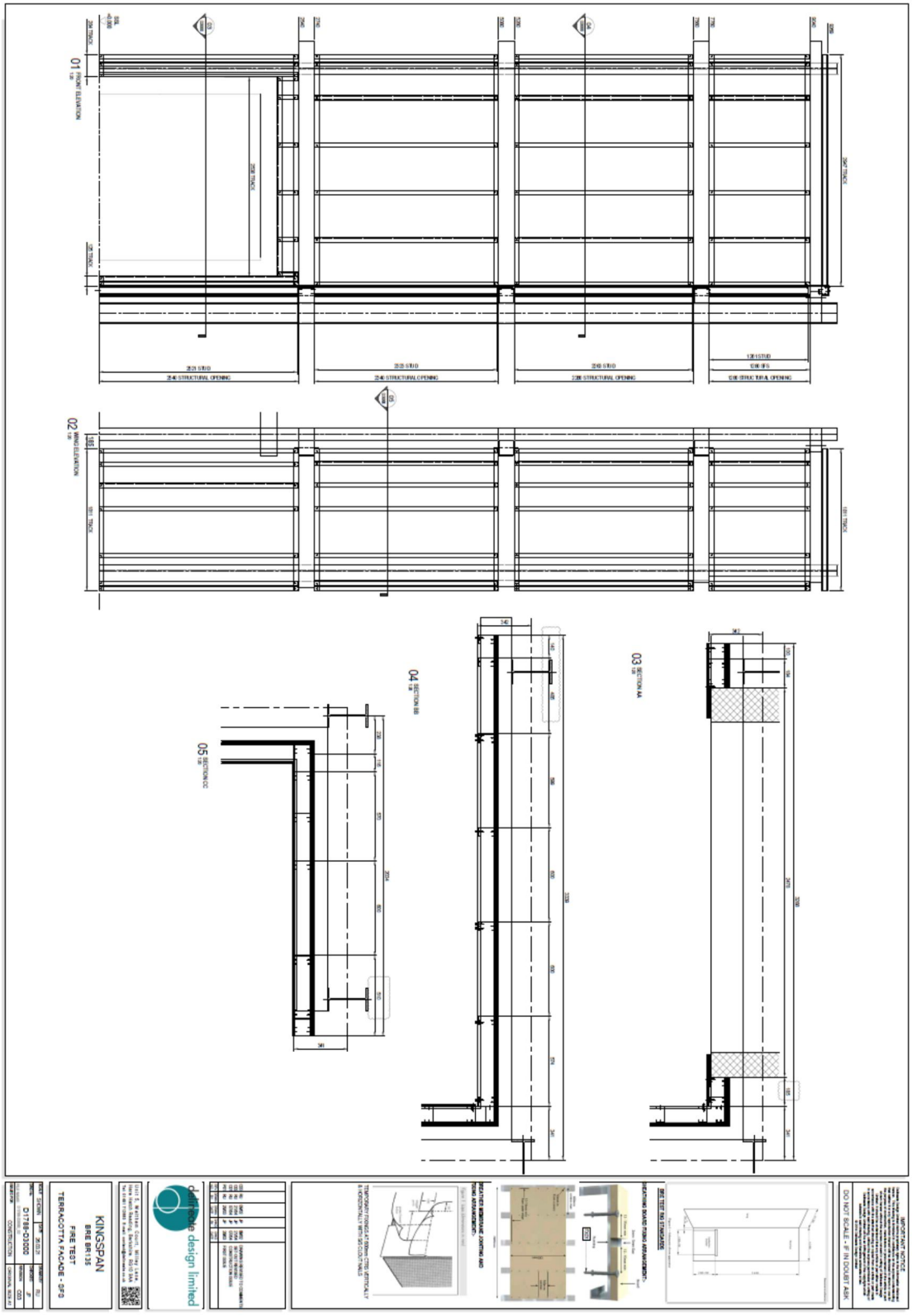

Figure 36. Steel Framing System layout (supplied by Test Sponsor).

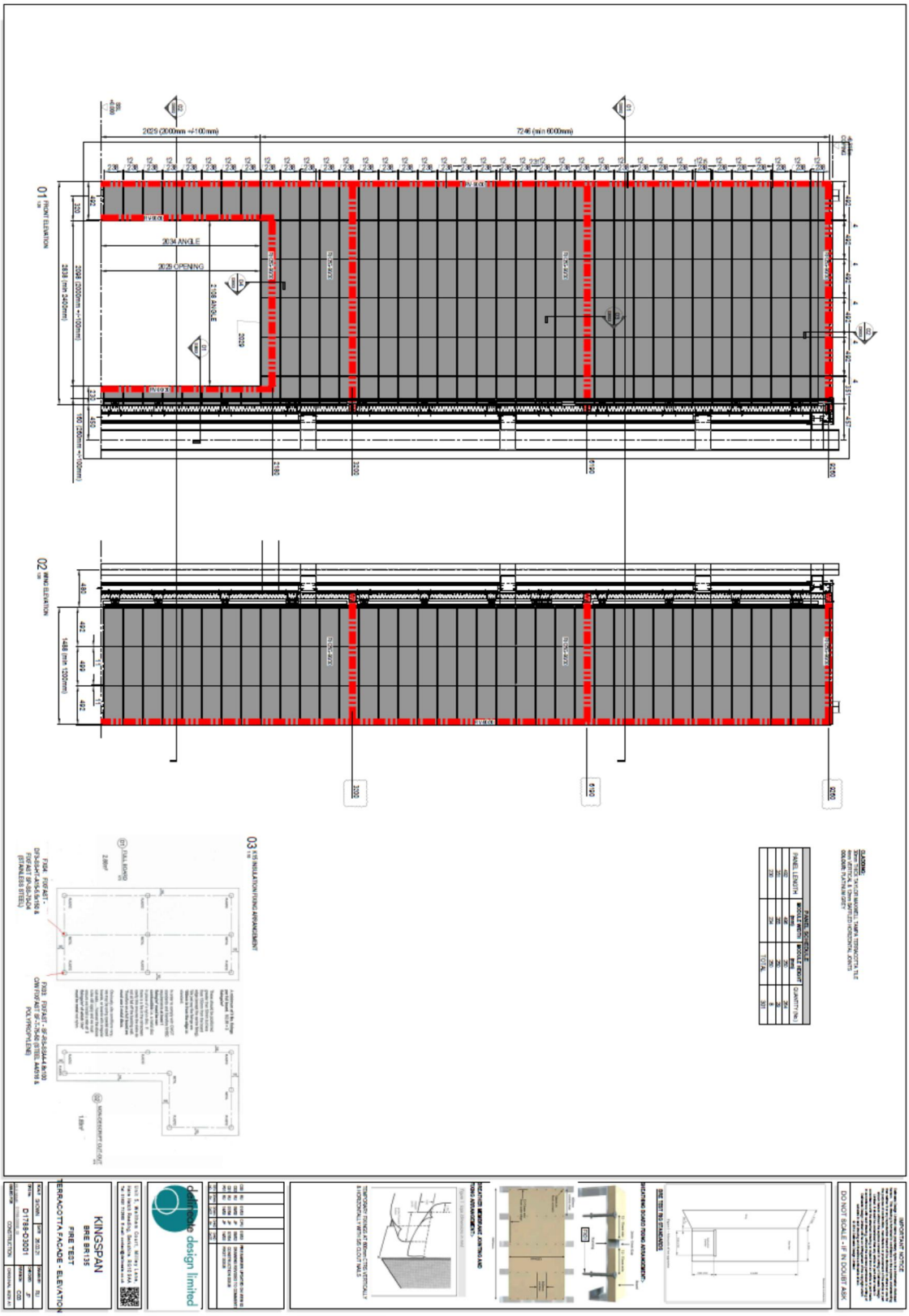

Figure 37. Tile layout & cavity barriers layout (supplied by Test Sponsor).

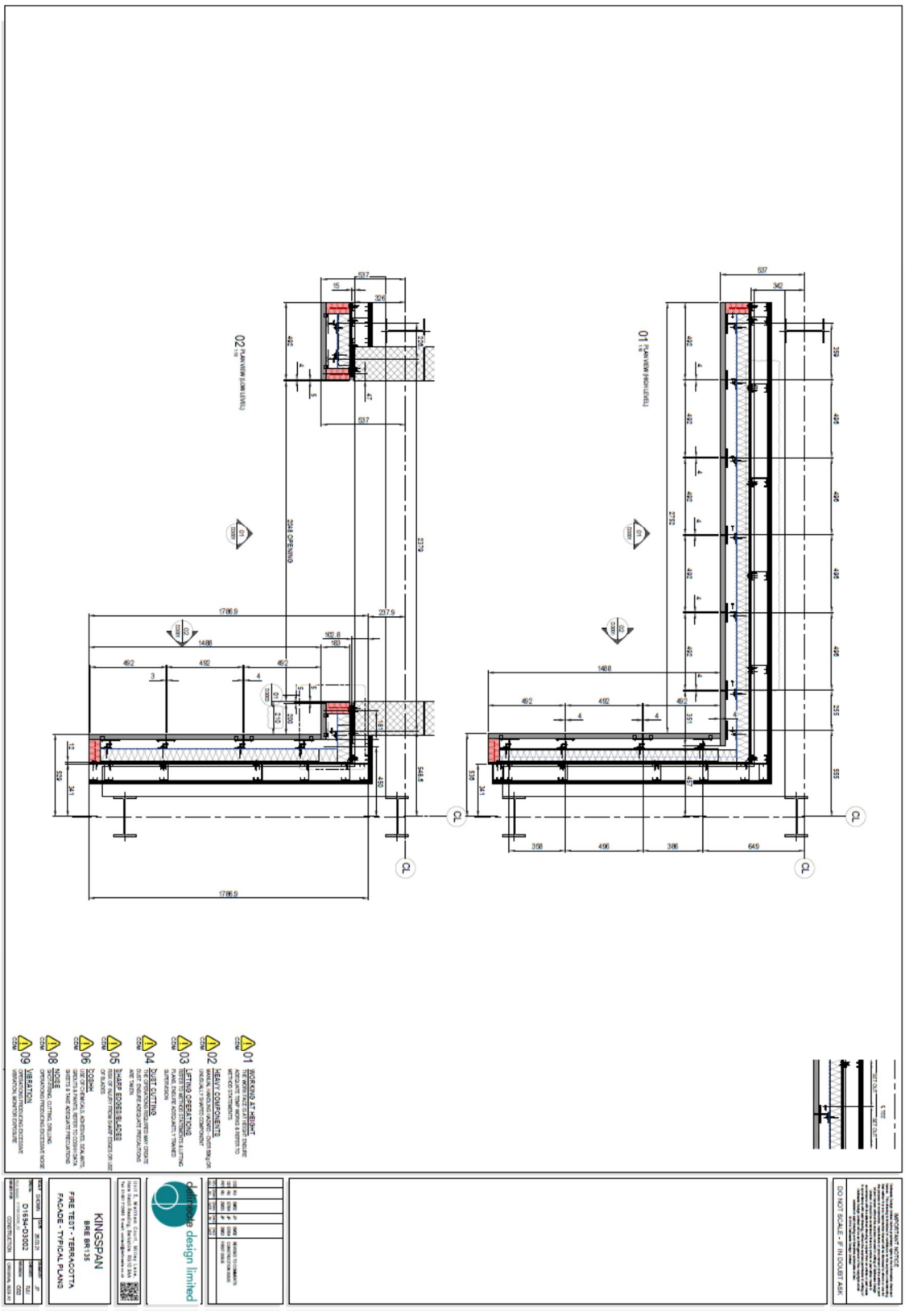

Figure 38. Top view of system layout (supplied by Test Sponsor).

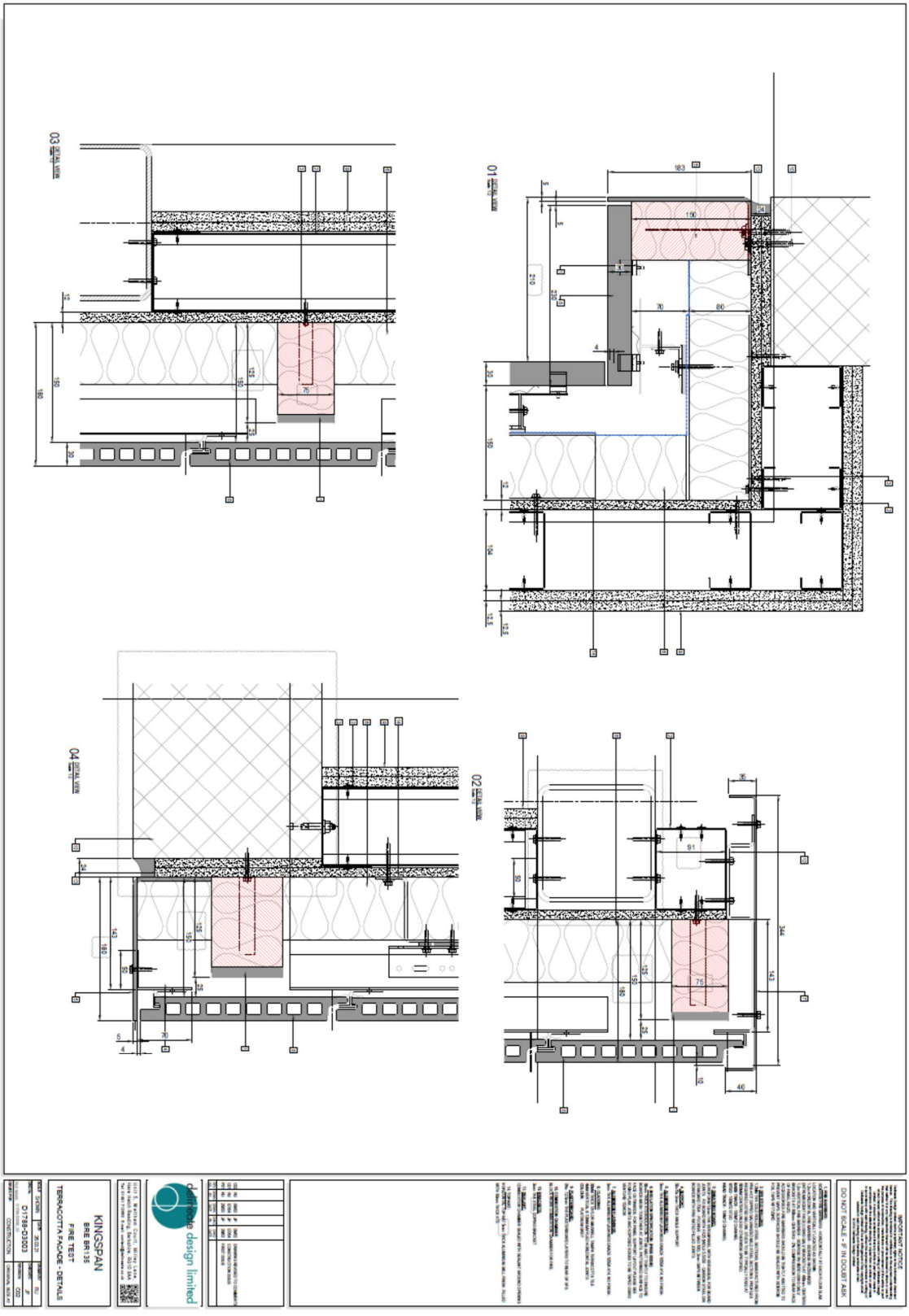

Figure 39. Cross-section (supplied by Test Sponsor).

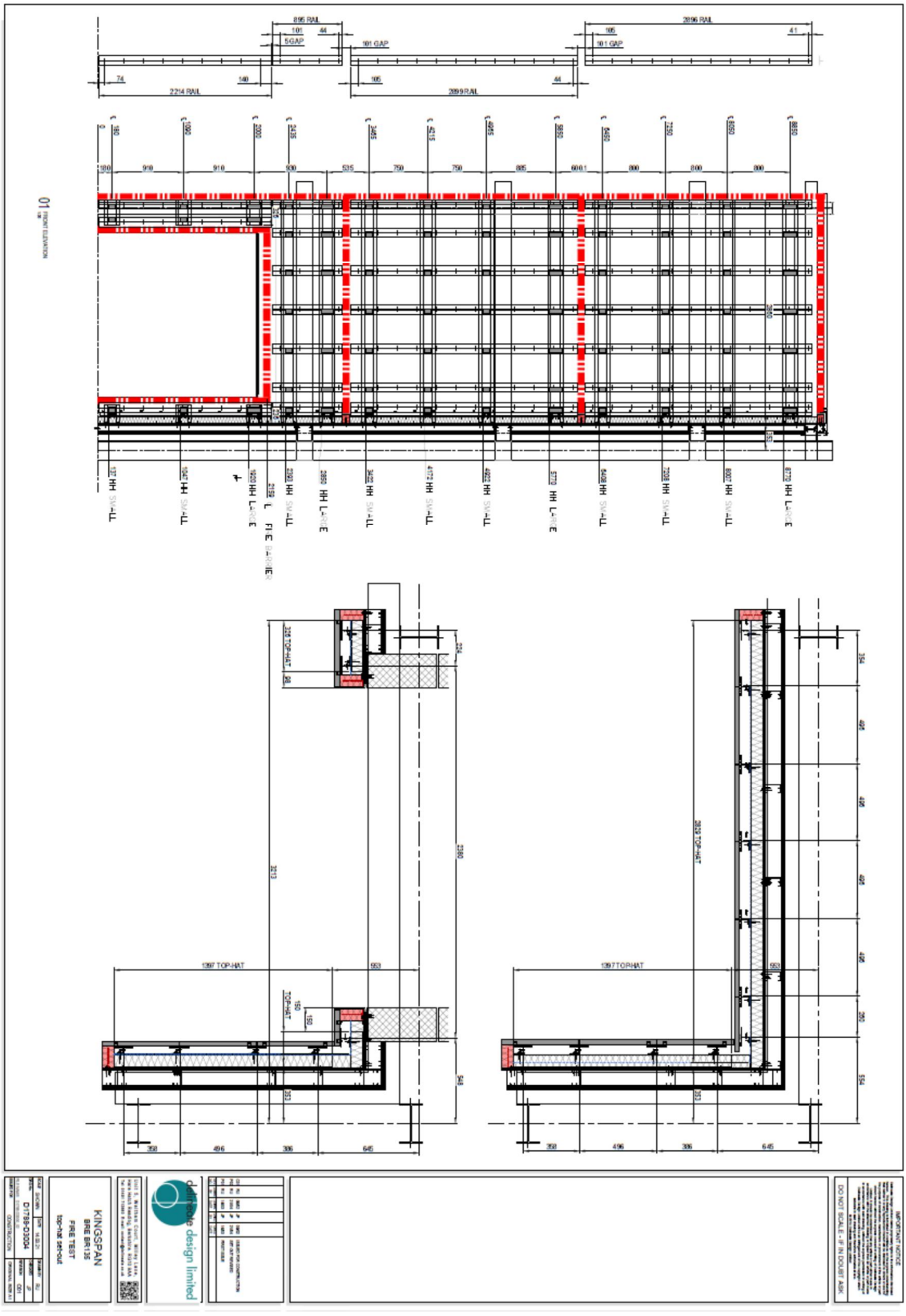

Figure 40. Top-hat channels & cavity barriers layout (supplied by Test Sponsor).

3.3 Critical dimensions

3.3.1 Test Standard requirements

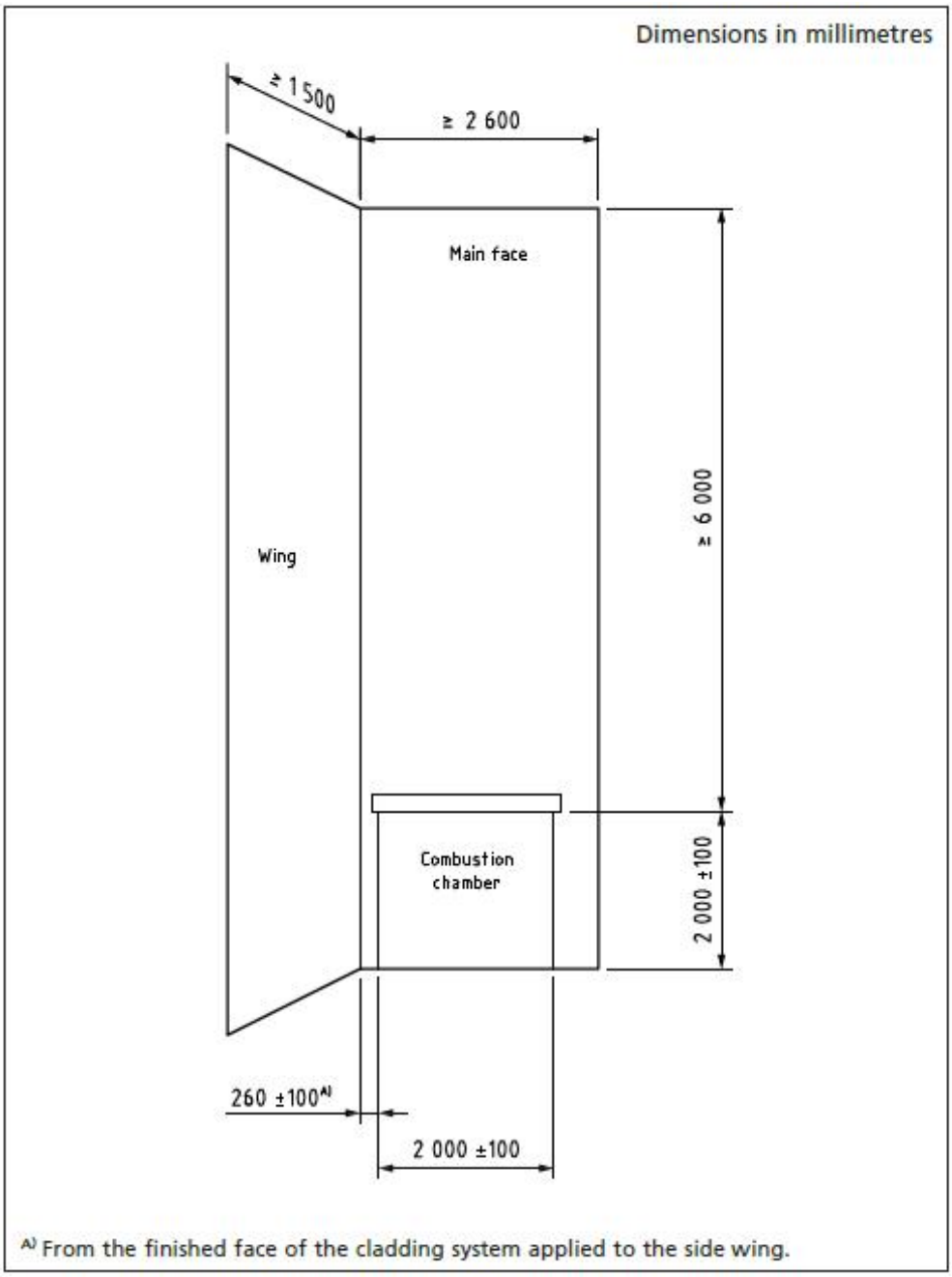

Figure 41. Test apparatus dimensions as specified by test Standard[1].

Note: The test apparatus may be constructed left- or right-handed.

3.3.2 Measured dimensions of cladding system

Item	Actual measurement	Criteria achieved?
≥6000mm above the top of the combustion chamber	7225mm	✓
≥2400mm width across the main wall	2805mm	✓
≥1200mm width across the wing wall	1490mm	✓
260mm (±100mm) wing wall-combustion chamber opening	210mm	✓
2000mm×2000mm (±100mm) combustion chamber opening	2100mm-wide×2050mm-high	✓
Horizontal joint (if present) placed 2400 (±100mm) above combustion chamber opening.	2495mm	✓
Vertical joint (if present) located on centre line of combustion chamber (±100mm).	60mm*	✓

*offset 60mm towards outside edge of main wall

4 Test Information

4.1 Test details

Project Number	P119586-1000
Sponsor	Kingspan Insulation
Type	BS 8414-2:2015+A1:2017
Date of test	12/05/2021
T_s (°c)	17
t_s (s)	110
t_s (min)	01:50
Burn through	No
Early termination	No

Ambient temperature: 17°C

Wind speed: <0.1m/s (test undertaken indoors).

Frequency of measurement: Data records were taken at ten second intervals.

4.2 Deviations from Test Standard

No deviations recorded.

4.3 Temperature data

Figures 43-50 provide the temperature profiles recorded during the test. *Figure 35* shows the system before the test.

Thermocouple set	Whole test	t_s + 15mins
Max Level 1: External	945°C (2003 @ ts+ 22:00)	-
Max Level 2: External	602°C (2025 @ ts+ 22:00)	474°C (2025 @ ts+ 14:40)
Max Level 2: Tile	285°C (2026 @ ts+ 27:10)	180°C (2026 @ ts+ 15:00)
Max Level 2: Cavity	212°C (2034 @ ts+ 27:40)	178°C (2034 @ ts+ 13:00)
Max Level 2: Insulation	124°C (2035 @ ts+ 11:40)	124°C (2035 @ ts+ 11:40)
Max Level 2: Sheathing board	88°C (2036 @ ts+ 11:20)	88°C (2036 @ ts+ 11:20)
Max Level 2: Steel Framing System	60°C (1027 @ ts+ 28:20)	37°C (1013 @ ts+ 14:50)
Max Level 2: Plasterboard	34°C (2031 @ ts+ 57:50)	30°C (1007 @ ts+ 12:30)

4.4 Thermocouple location and panel layout

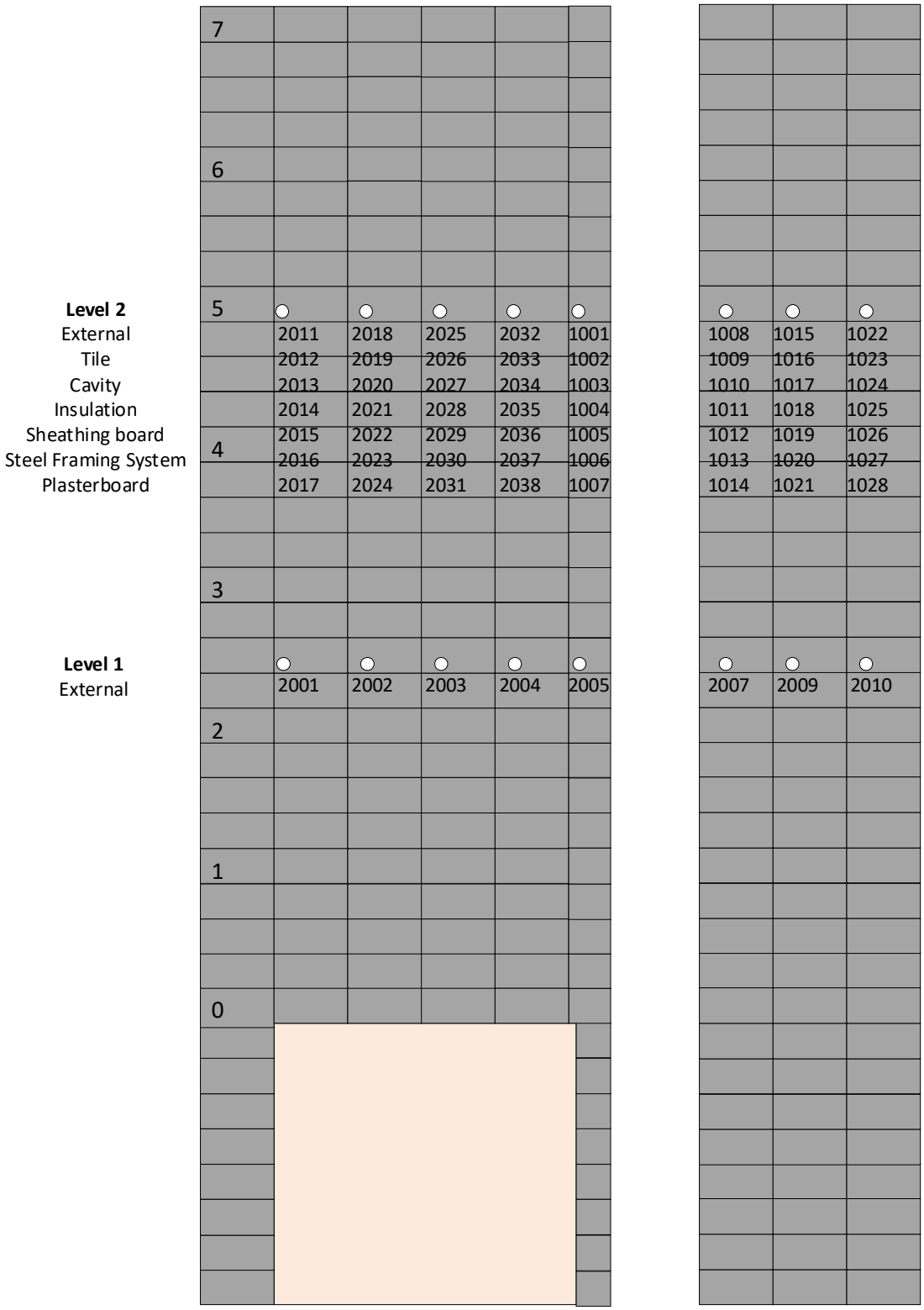

Figure 42. Layout of panels, TC positions and numbering system used for reporting. Not to scale

4.5 Visual observations

Table 2. Visual Observations – Refer to *Figure* 42 for system schematic. Height measurements are approximate and given relative to a zero at the top of the combustion chamber. Unless otherwise specified, observations refer to the centre line above the combustion chamber on the main wall.

Time* (mm:ss)	t_s (mm:ss)	Description
00:00		Ignition of crib
01:20		Flame tips to cladding system
01:50	00:00	Start time (t_s) criteria achieved: External temperature 2.5m above the top of the combustion chamber in excess of 217˚C (=200˚C+T_s)
02:30	00:40	Flame tips to level 1 thermocouples
04:10	02:20	Flame tips to level 2 thermocouples
08:20	06:30	Flame tips to 6m above combustion chamber
10:00	08:10	Distortion to combustion chamber surround top edge
13:50	12:00	Falling debris
15:00	13:10	Melting to combustion chamber surround top edge
16:15	14:25	Flaming to combustion chamber surround left-hand side
16:55	15:05	Detachment of tiles up to 0.2m above combustion chamber opening
18:55	17:05	Detachment of tiles up to 1.5m above combustion chamber opening
19:35	17:45	Further detachment of tiles up to 1.5m above combustion chamber opening
20:00	18:10	Further detachment of tiles up to 1.5m above combustion chamber opening
20:45	18:55	Detachment of tiles up to 2.5m above combustion chamber opening
21:15	19:25	Further detachment of tiles up to 2.5m above combustion chamber opening
22:00	20:10	Further detachment of tiles up to 2.5m above combustion chamber opening. Flaming debris
22:35	20:45	Flaming debris
23:50	22:00	Detachment of tiles up to 3m above combustion chamber opening
24:15	22:25	Flaming debris
24:30	22:40	Further detachment of tiles up to 3m above combustion chamber opening
25:35	23:45	Detachment of tiles up to 3.5m above combustion chamber opening
27:50	26:00	Falling debris
28:05	26:15	Further detachment of tiles up to 3.5m above combustion chamber opening
29:35	27:45	Flaming behind tiles at 3.8m above combustion chamber opening
30:00	28:10	Crib extinguished Continued flaming from main wall at 3-4m and 1m above combustion chamber opening
33:50	32:00	Localised areas of flaming at 3-5m above combustion chamber opening
45:00	43:10	Flaming ceased except for an area at 3m above combustion chamber opening
57:30	55:40	Flaming ceased
60:00	58:10	Test complete

*Time from point of ignition.

4.6 Mechanical performance

Time references given from point of ignition in the format mm:ss.

Observation	Details*
Ongoing system combustion following extinguishing of the ignition source	30:00-57:30
System collapse	16:55-28:05
Spalling	Not observed.
Delamination	Not observed.
Flaming debris	22:00-24:15
Pool fire	Not observed.

*with reference to *Table 2*.

4.7 Temperature profiles

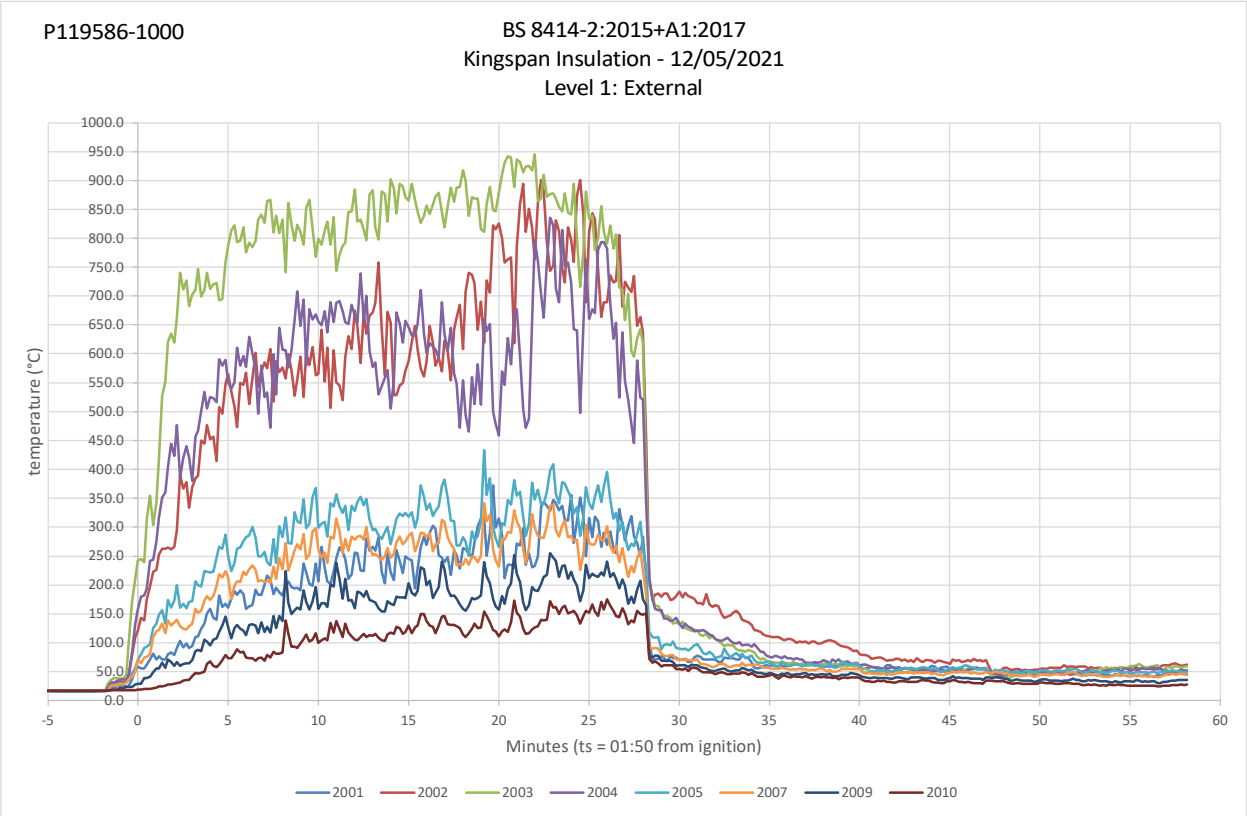

Figure 43. Level 1 external thermocouples.

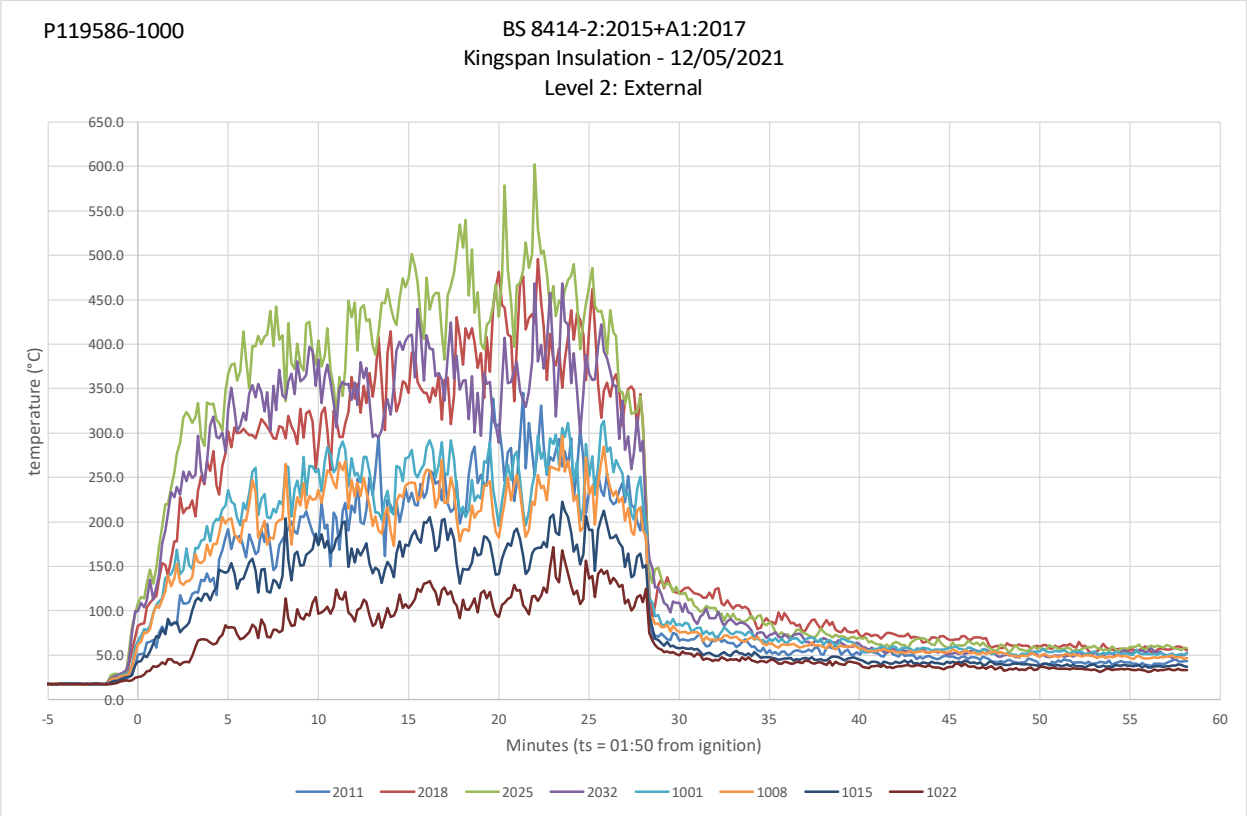

Figure 44. Level 2 external thermocouples.

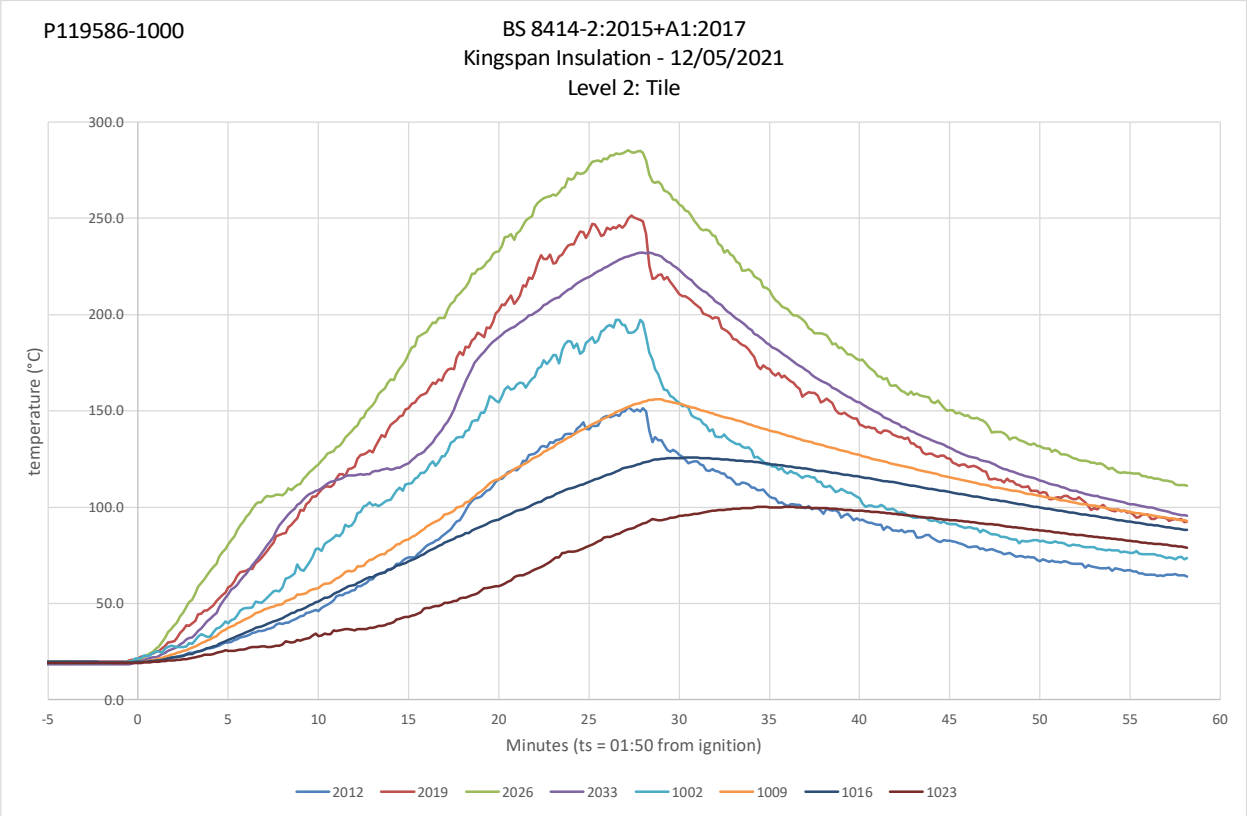

Figure 45. Level 2 tile thermocouples.

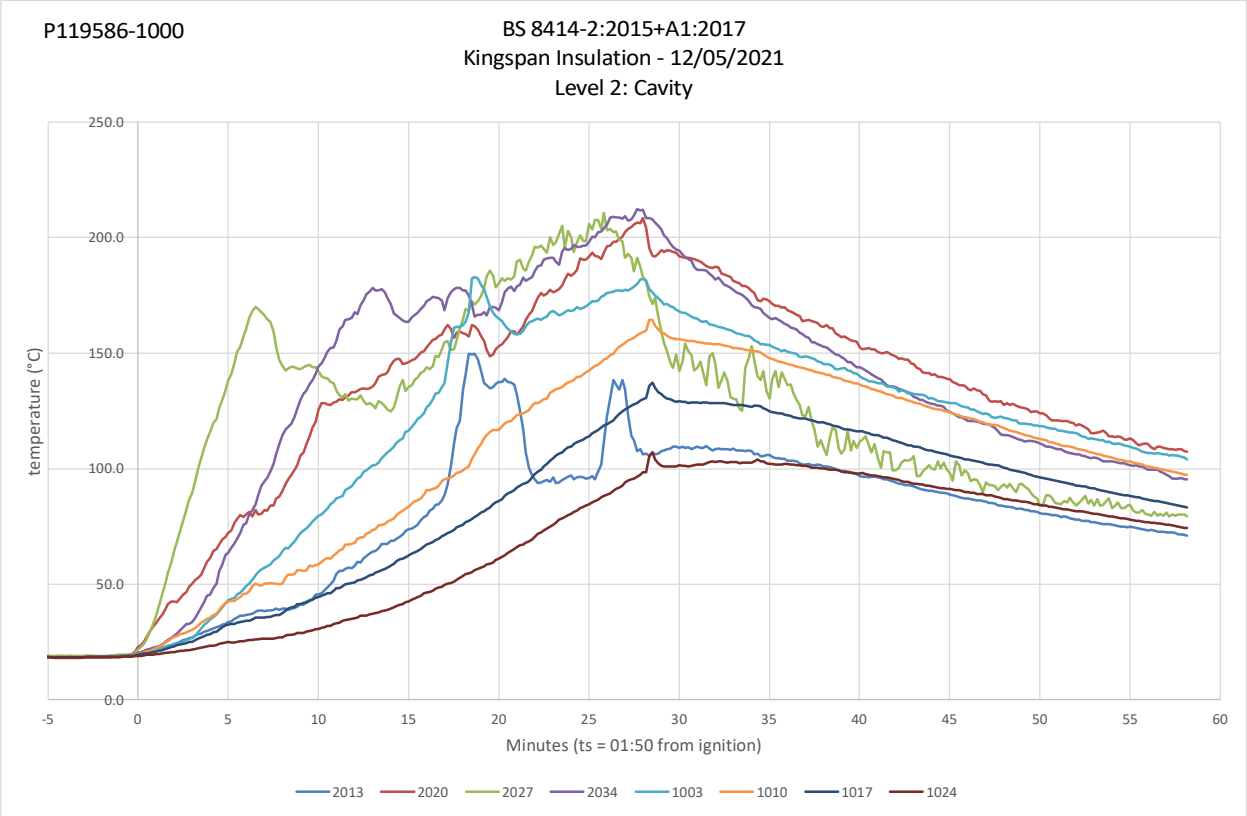

Figure 46. Level 2 cavity thermocouples.

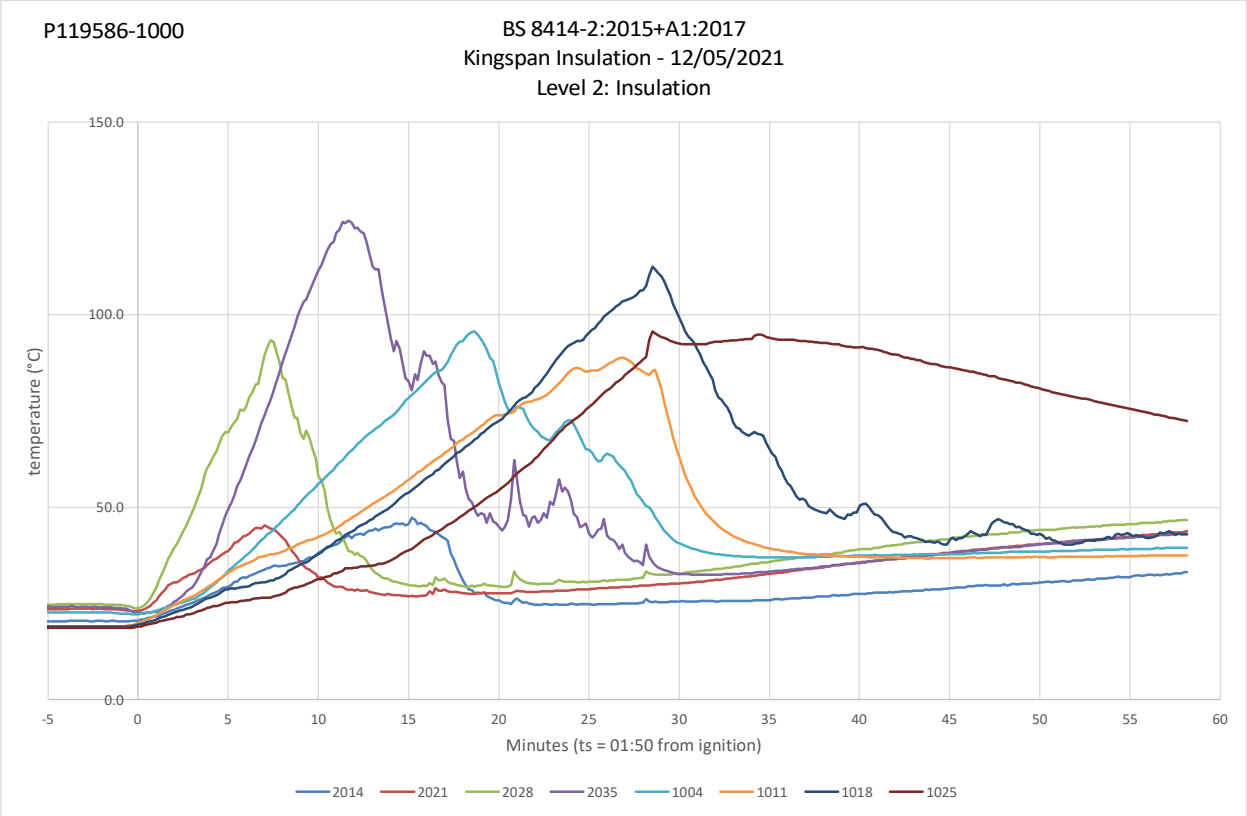

Figure 47. Level 2 insulation thermocouples.

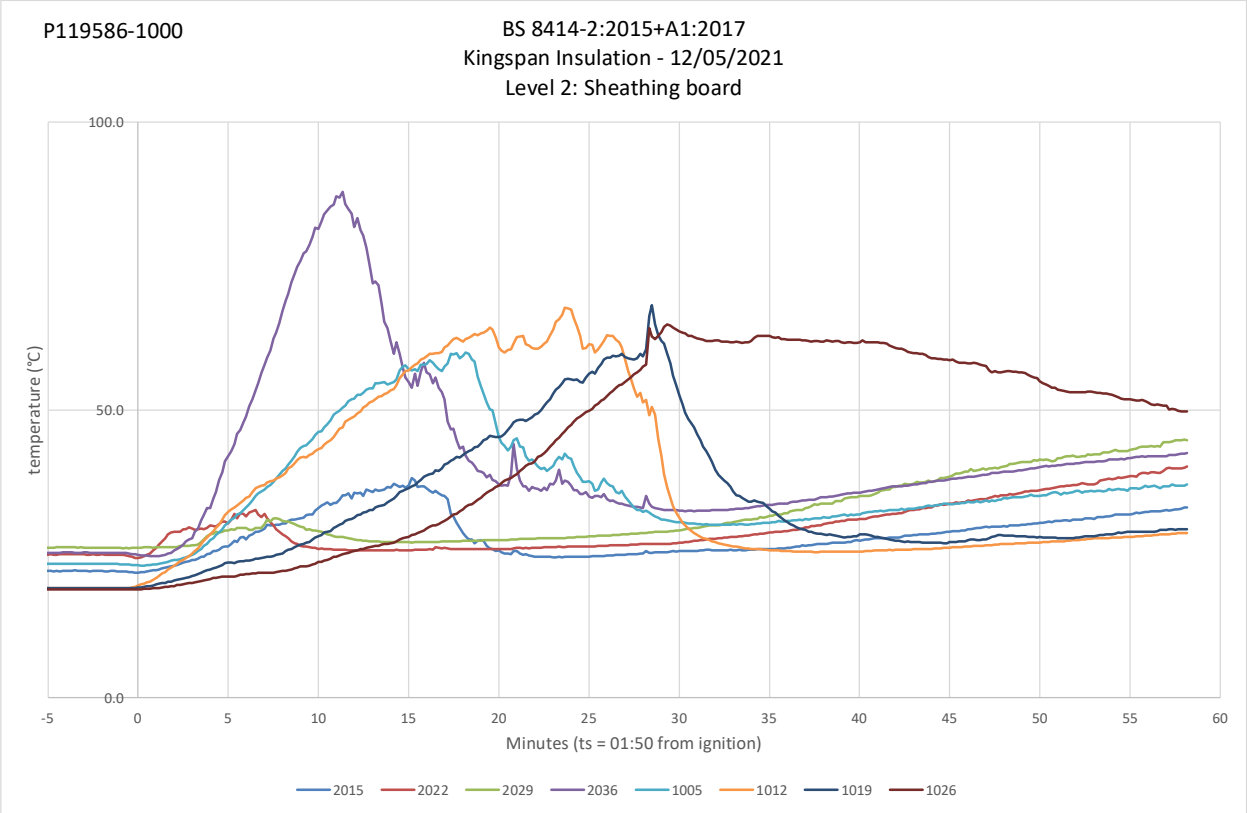

Figure 48. Level 2 sheathing board thermocouples.

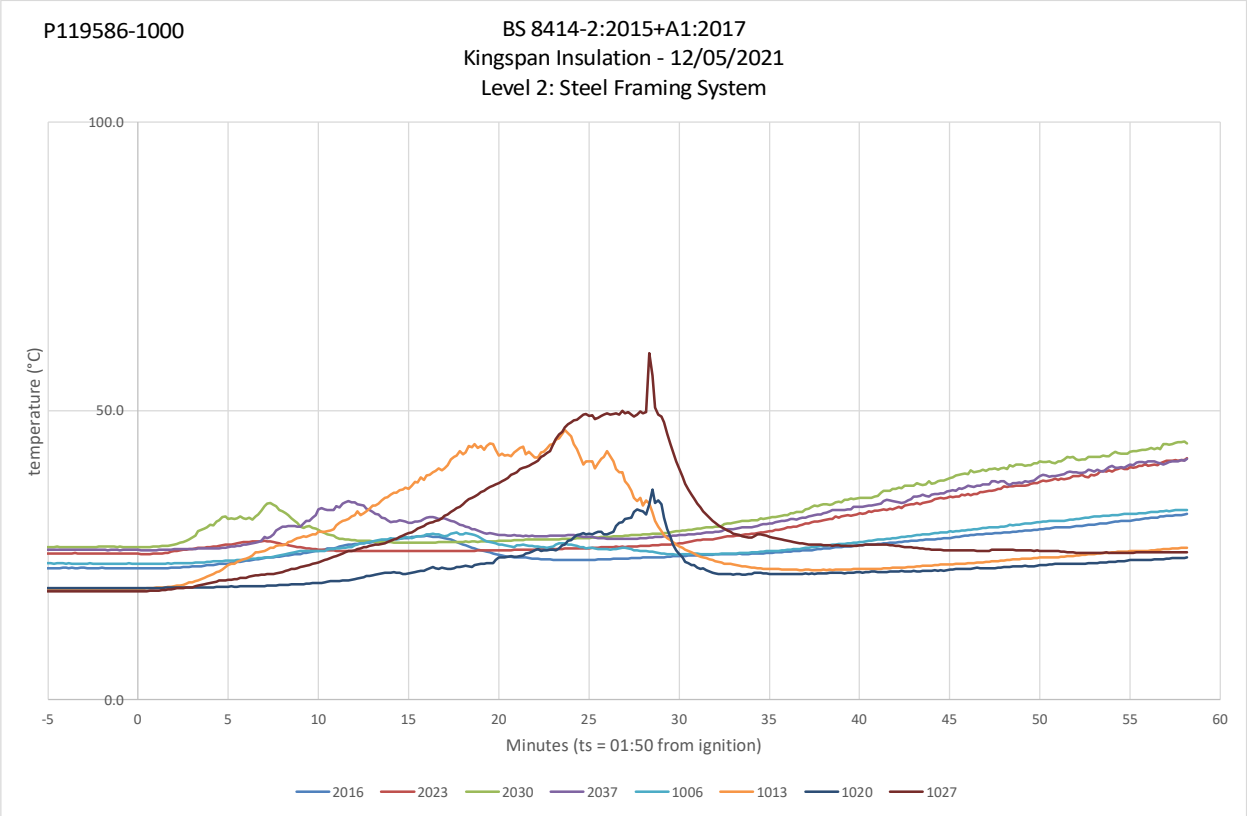

Figure 49. Level 2 steel framing system thermocouples.

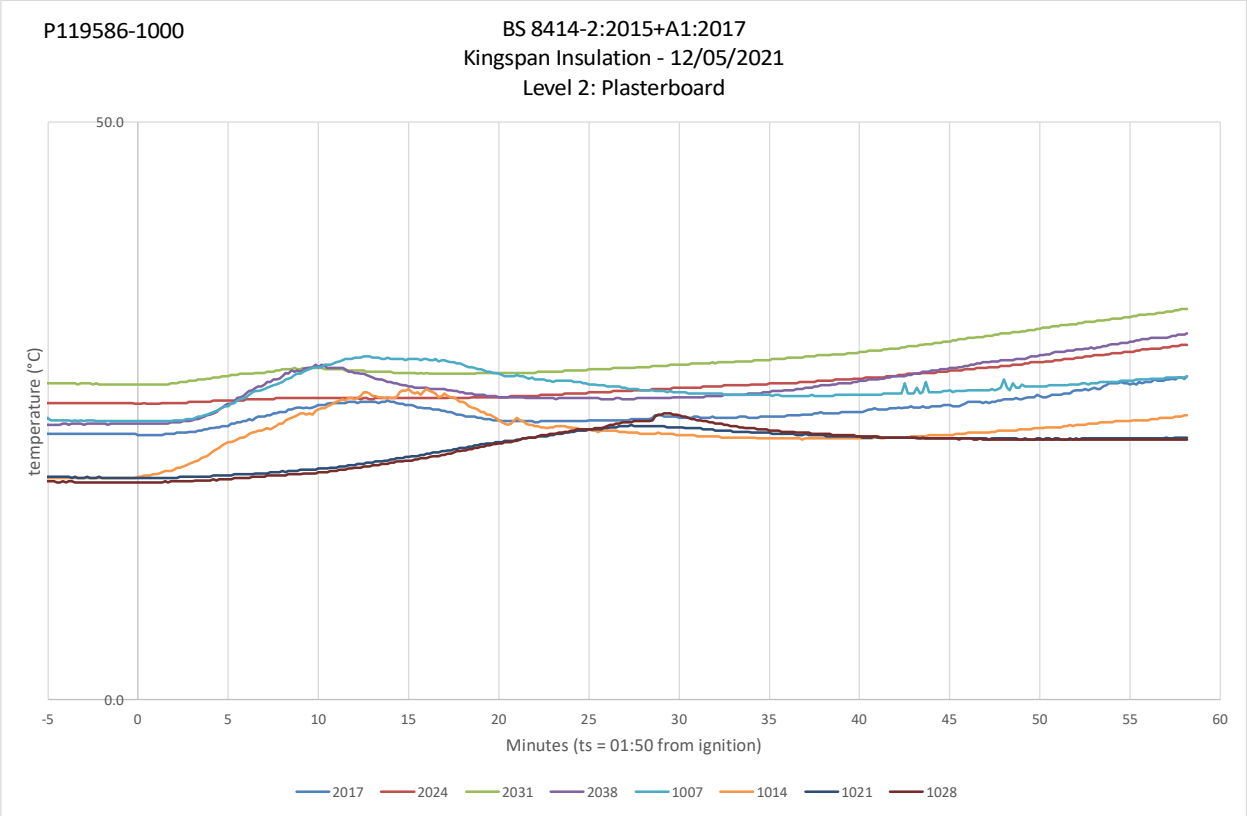

Figure 50. Level 2 plasterboard thermocouples.

5 System Damage

5.1 Tiles

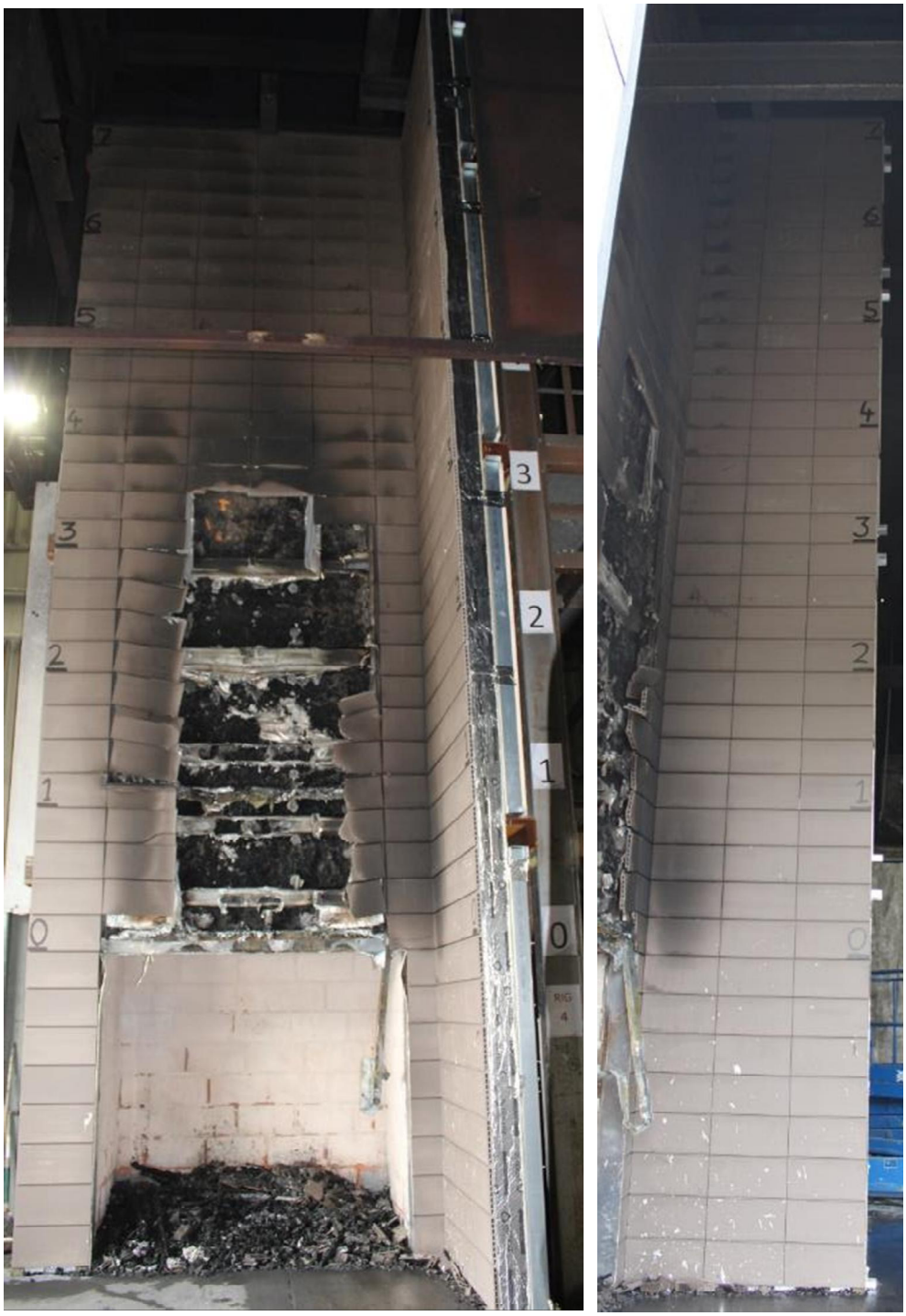

Figure 51. Full-height photograph of cladding system immediately after test.

Figure 52. Top of system capping.

On the main wall, the tiles had detached in an area approx. 1 to 2m-wide (min/max)×3.6m-high (approx. 4.8m^2) above the combustion chamber opening. Tiles were discoloured from the combustion chamber opening to top of system.

On the wing wall, tiles were discoloured along the main-wing junction approx. 500mm-wide, 2m from ground to top of system.

Capping at the top of the system remained in place with no visible damage.

5.2 Rails

Figure 53. Full-height photograph following removal of tiles.

On the main wall, the centre rail in line with the combustion chamber centre line had melted up to 4m, the rails immediately either side of it had melted to 3.2m above the combustion chamber opening. All rails had signs of distortion up to 4m above the combustion chamber opening with discolouration to top of system.

On the wing wall, the rails remained in place with no visible damage.

5.3 Insulation & brackets

Figure 54. Full-height photograph following removal of rails

On the main wall, the insulation was charred or had detached/been consumed up to 4.2m-high×2m-wide above the combustion chamber opening, and was discoloured to top of system. On the wing wall, the insulation remained in place with no visible damage.

The brackets had melted in line with the rails and discoloured in line with the combustion chamber opening width to top of system.

5.4 Horizontal & vertical cavity barriers

Figure 55. Full-height photograph following removal of insulation and brackets.

The vertical cavity barriers either side of the combustion chamber opening were discoloured at the top edge approx. 400mm-high. The vertical cavity barriers located at the outer edges of both walls remained in place with no visible damage.

Figure 56. Photograph of the horizontal cavity above combustion chamber.

The horizontal cavity barrier located directly above the combustion chamber had fully activated across the full width. Sections of the intumescent strip had detached.

Figure 57. Photograph of the 1st full width horizontal cavity barrier.

On the main wall, the 1st full width horizontal cavity barrier had fully activated across the full width.

On the wing wall, the horizontal cavity barrier had signs of expansion at the junction approx. 300mm-wide.

Figure 58. Photograph of the 2nd full width horizontal cavity barrier.

On the main wall, the 2nd full width horizontal cavity barrier had fully activated across the full width.

On the wing wall, the horizontal cavity barrier had signs of expansion at the junction approx. 300mm-wide.

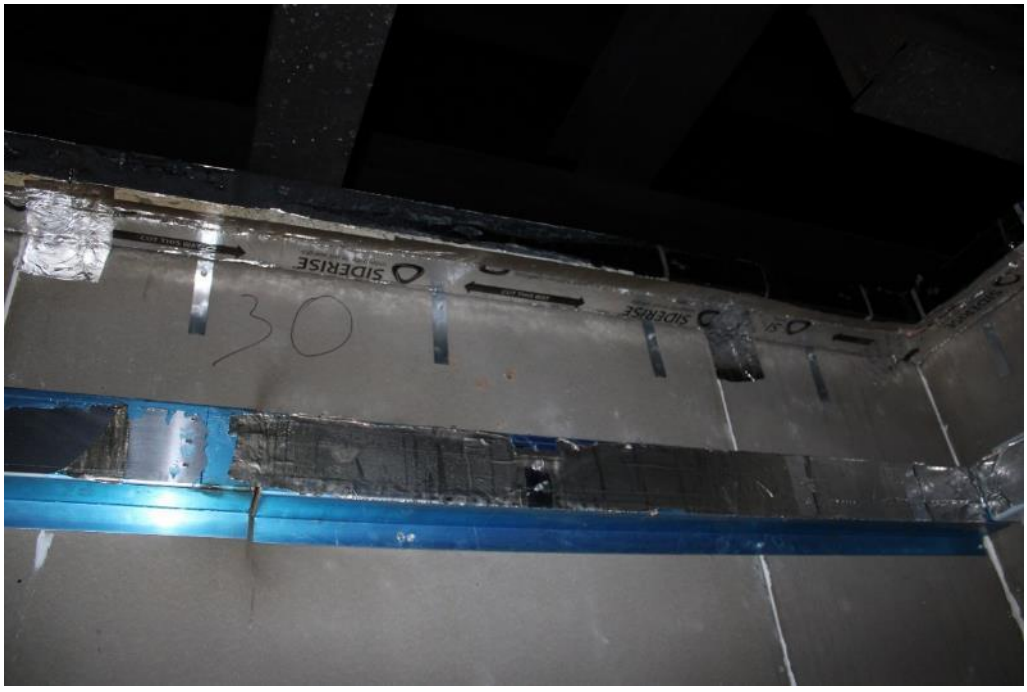

Figure 59. Photograph of the 3rd full width horizontal cavity barrier.

On the main wall, the 3rd full width horizontal cavity barrier had signs of expansion at the centre of barrier.

On the wing wall, the horizontal cavity barrier had no visible signs of damage.

5.5 Top-hat channels

Figure 60. Full-height photograph following removal of cavity barriers.

On the main wall, the first three top-hat channels above the combustion chamber had melted on the front face across a width ranging from 200-700mm. The channels had distorted up to the fourth row above the combustion chamber. All top-hat channels were discoloured to top of system in line with the combustion chamber opening.

On the wing wall, the top hat channels had no visible signs of damage.

5.6 Combustion chamber surround flashing

Figure 61. Photograph of combustion chamber surround flashing.

The combustion chamber surround flashing had melted across the full-width of the horizontal edge. The vertical sides were distorted and discoloured to full height.

5.7 Sheathing board

Figure 62. Full-height photograph following removal of the top-hat channels.

On the main wall, the cement board face was discoloured up to 4.2m above the combustion chamber opening to full width of wall.

On the wing wall, the cement board had no visible signs of damage.

5.8 Steel framing system & plasterboard

Figure 63. Full-height photograph of the steel framing system and plasterboard (exposed face).

The SFS and plasterboard remained intact and in place with no visible damage. There was some smoke staining localised to the Level 1 thermocouple holes.

Figure 64. Post-test photograph of the plasterboard (unexposed face) - Level 1 thermocouples.

Figure 65. Post-test photograph of the plasterboard (unexposed face) – Level 2 thermocouples.

The unexposed face of the plasterboard remained intact and in place with no visible damage.

6 Conclusion

BS8414-2:2015 + A1:2017 [1] does not contain acceptance criteria and therefore this test report does not indicate a pass or fail of the product.

7 Limitations

Because of the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement of fire testing, it is not possible to provide a stated degree of accuracy of the results.

8 Reference

1. BS 8414-2:2015 + A1:2017, 'Fire performance of external cladding systems – Part 2: Test method for non-loadbearing external cladding systems fixed to and supported by a structural steel frame', British Standards Institution, London, 2017.

Report Ends