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BRE Global Test Report

Classification of fire performance in accordance with BR 135: 2013 Annex A for a ventilated façade system with Kingspan (K15) thermal insulation and ACM panels Booth Muirie BML400 rivet fixed

Prepared for: **Mitsubishi Chemical Corporation**

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CLASSIFICATION OF FIRE PERFORMANCE IN ACCORDANCE WITH BR 135:2013 Annex A

Sponsor: Mitsubishi Chemical Corporation, 1-1, Manurouchi 1-chrome, Chiyoda-ku, Tokyo 100-8251, Japan

Prepared by: BRE Global Ltd, BRE, Bucknalls Lane, Garston, Watford, WD25 9XX, England

Product name: Ventilated façade system with Kingspan (K15) thermal insulation and ACM panels Booth Muirie BML400 rivet fixed

Classification report No.: P109971-1001

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This classification report consists of 19 pages and may only be used or reproduced in its entirety.

1 Introduction

This report presents the classification of the system detailed in Section 2. The classification is carried out in accordance with the procedures given in BR 135 – 'Fire performance of external thermal insulation for walls of multi-storey buildings', Third edition, Annex A 2013. This classification should be read in conjunction with this document and the associated test reports referenced in Section 4.

2 Details of the Classified System

2.1 Description of substrate

The test specimen was installed onto wall number 1 of the BRE Global External Cladding Test Facility.

This is a multi-faced test facility constructed from steel with the cladding system affixed to the masonry substructure.

2.2 Description of product

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

Item	Description
1	90mm-high×64mm-wide×113-deep×4mm-thick aluminium 'L' shaped brackets fixed with a single 90mm-long×ϕ8mm stainless steel screw anchor with plastic plug
2	100mm-thick phenolic foam type K15 insulation boards, with aluminium faces on both sides
3	120mm-wide×60mm-deep×2mm-thick aluminum 'T'-section framing and 40mm-wide×60mm-deep×2mm-thick aluminum 'L'-section framing
4	75mm-wide×160mm-deep stone wool vertical cavity barriers with 10mm compression (Siderise RSV90/30 labeled "Lamatherm")
5	75mm-wide×125mm-deep stone wool with intumescent horizontal cavity barriers (Siderise RH25G90/30 labeled "Lamatherm")
6	4mm-thick ACM (aluminium composite material) panels (Booth Muirie BML400 rivet fixed). ALPOLIC/A2. The mean calorific value measured for the core was 2.2797 MJ/Kg. BRE Report P110396-1000[2].

2.3 Installation sequence

Onto the masonry support structure, the aluminium 'L'-shaped brackets were fixed in position on low density polyethylene isolation pads (5mm-thick) using a single stainless steel screw anchor and plastic plug.

On the main face, the horizontal spacing between the brackets varied between 340mm and 500mm and on the wing wall the spacing between the brackets was 645mm as specified in the manufacturer's details. The vertical spacing between the brackets was 960mm and where horizontal cavity barriers were present a spacing of 410mm was used.

The system included vertical and horizontal cavity barriers. On the main face, two 75mm-wide×160mm-deep stone wool vertical cavity barriers, with 10mm compression, were fixed in position either side of the combustion chamber opening with a clear distance of 2100mm between them.

The vertical cavity barriers were skewered to ¾-depth on steel brackets fixed into the masonry wall with one 70mm-long×ϕ4mm anchor. Two steel brackets were used for each length of 1200mm of stone wool cavity barrier.

On the wing wall, one 75mm-wide×160mm-deep stone wool vertical cavity barrier, with 10mm compression, was fixed in position at the edge of the system, approximately 1340mm from the external face of the main wall. Once installed in position the stone wool vertical cavity barriers were compressed by the ACM panels to fully close the 50mm ventilated cavity.

A set of four 75mm-wide×125mm-deep intumescent horizontal cavity barriers were butted up to the continuous vertical barriers and fixed in rows at approximate heights of:

- 0mm above the combustion chamber opening;
- 2320mm above the first cavity barrier;
- 2360mm above the second cavity barrier;
- 1560mm above the third cavity barrier (close to the top of the ventilated system).

The horizontal cavity barriers were fixed through the entire depth on face turned steel brackets. Two steel brackets were used per 1200mm length of stone wool cavity barrier, each fixed into the masonry wall with one 70mm-long×ϕ4mm anchor, positioned above the cavity barrier. The horizontal intumescent cavity barriers were installed with a maximum gap of 25mm to the back face of the panel in accordance with the manufacturer's recommendation.

The 100mm-thick foil-faced Kingspan K15 phenolic insulation panels (supplied in 2400mm×1200mm panels and cut to fit) were installed in position through the substructure bracket fixing systems and fixed to the support structure (masonry wall) with five 125mm-long×ϕ8mm plastic anchors and four 140mm-long×ϕ8mm stainless steel anchors per full size panel. The insulation panels were installed with the long edge orientated horizontally. All the gaps between the insulation panels and at the intersection with the cavity barriers or aluminium brackets were sealed with aluminium tape as recommended by the manufacturer.

After the insulation was fixed in position the L'-section framing was installed at horizontal spacings of 470mm. The horizontal spacing between successive sections of aluminium 'T'-section or 'L'-section framing was 970mm. The aluminum vertical rails, with a typical length of 2300mm, were positioned 10mm inside the thermal insulation with each rail fixed to the brackets with 2×4.8×16mm self-drilling, self-tapping, stainless steel screws. The aluminum rails were installed with a 30mm gap at the floor levels to allow for structural movement. Three brackets supported each section of rail: the middle bracket was fixed while the top and bottom brackets were connected with movement holes.

The external ACM panels (Booth Muirie BML400 rivet fixed) of the system were installed on to the rail substructure with one fixed point (ϕ6mm hole) in the middle and twenty (per full size panel) oversize (ϕ8.5mm holes) fixings into the rail substructure, at 450mm horizontal spacings and 375mm vertical spacings. A nominal gap of 20mm was provided between the panels to maintain the ventilation of the cavity. The measured gaps after installation varied between 19mm and 22mm. The full-size ACM panel (Booth Muirie BML400 rivet fixed) dimensions measured 950mm-wide×2310mm-high.

A pre-fabricated, welded window pod constructed from 5mm-thick aluminium was fixed onto the edge of the combustion chamber opening with eight (two on top, three on both vertical edges) 90mm-long×ϕ8mm stainless steel screw anchor and plastic plugs.

The cladding system measured:

Requirement	Actual measurement
≥6000mm above the top of the combustion chamber	6500mm
≥2400mm width across the main wall	2635mm
≥1200mm width across the wing wall	1355mm
260mm (±100mm) wing wall-combustion chamber opening	305mm
2000mm (H) x 2000mm (W) (±100mm) combustion chamber opening	2000mm×1950mm

2.4 Installation of Specimen

All test materials were supplied and installed by the sponsor. BRE were not involved in the sample selection process and therefore cannot comment upon the relationship between samples supplied for test and the product supplied to market.

3 Product Specification

Figure 1. Completed installation prior to test.

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3.1 System drawings

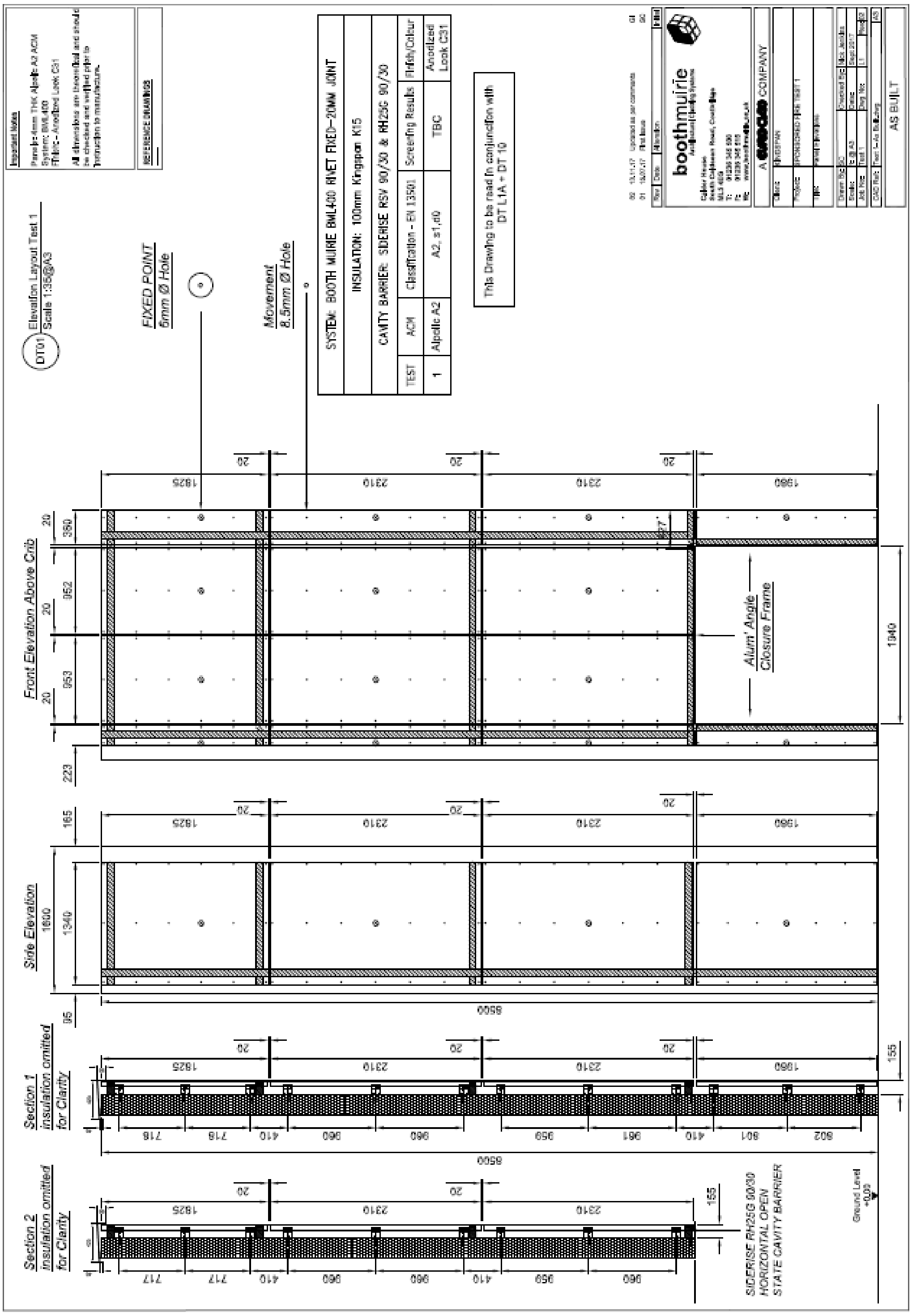

Figure 2 Front elevation, side elevation and vertical sections through the system (supplied by the Test Sponsor).

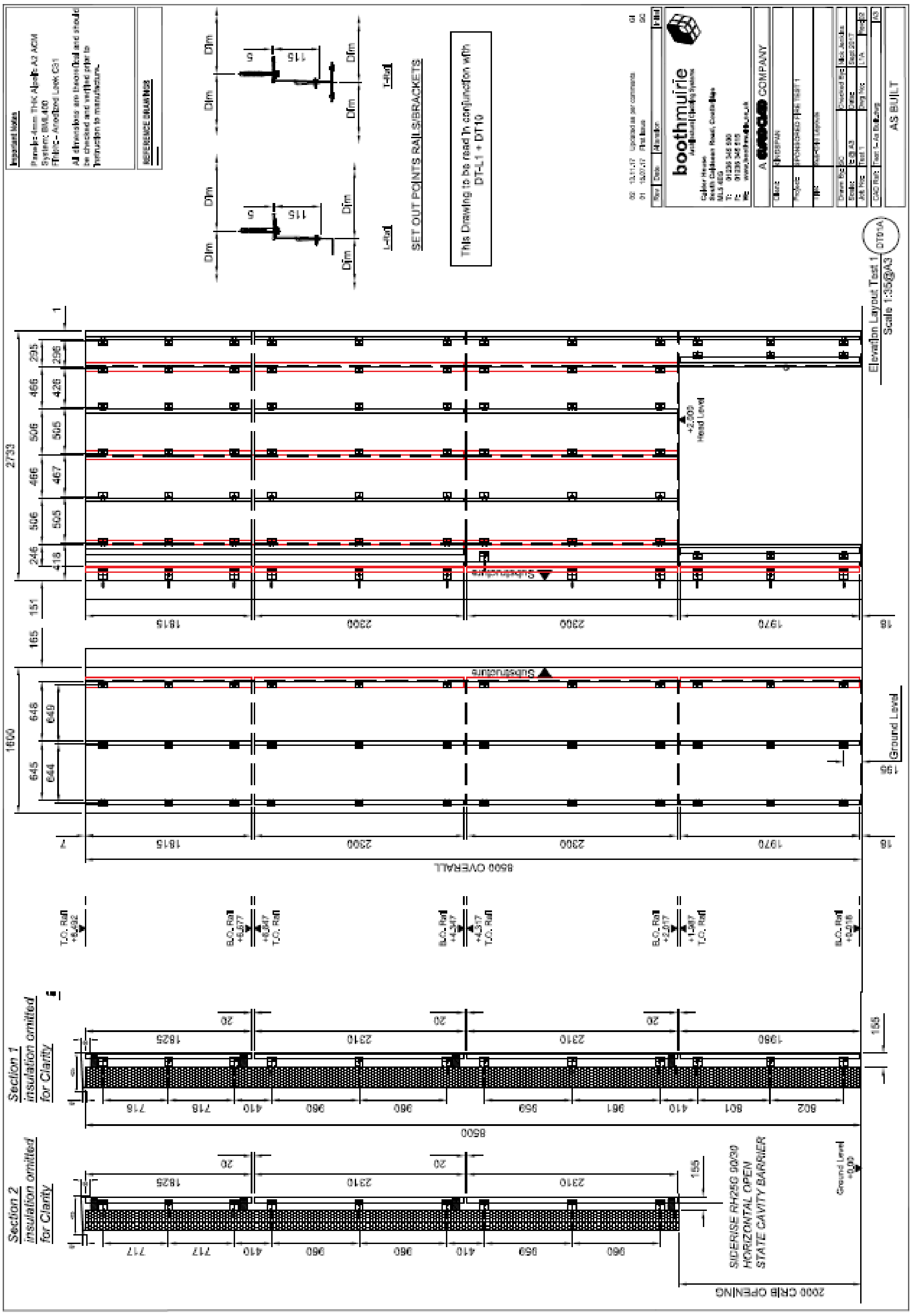

Figure 3. Front elevation, side elevation and vertical sections for the system substructure (supplied by the Test Sponsor).

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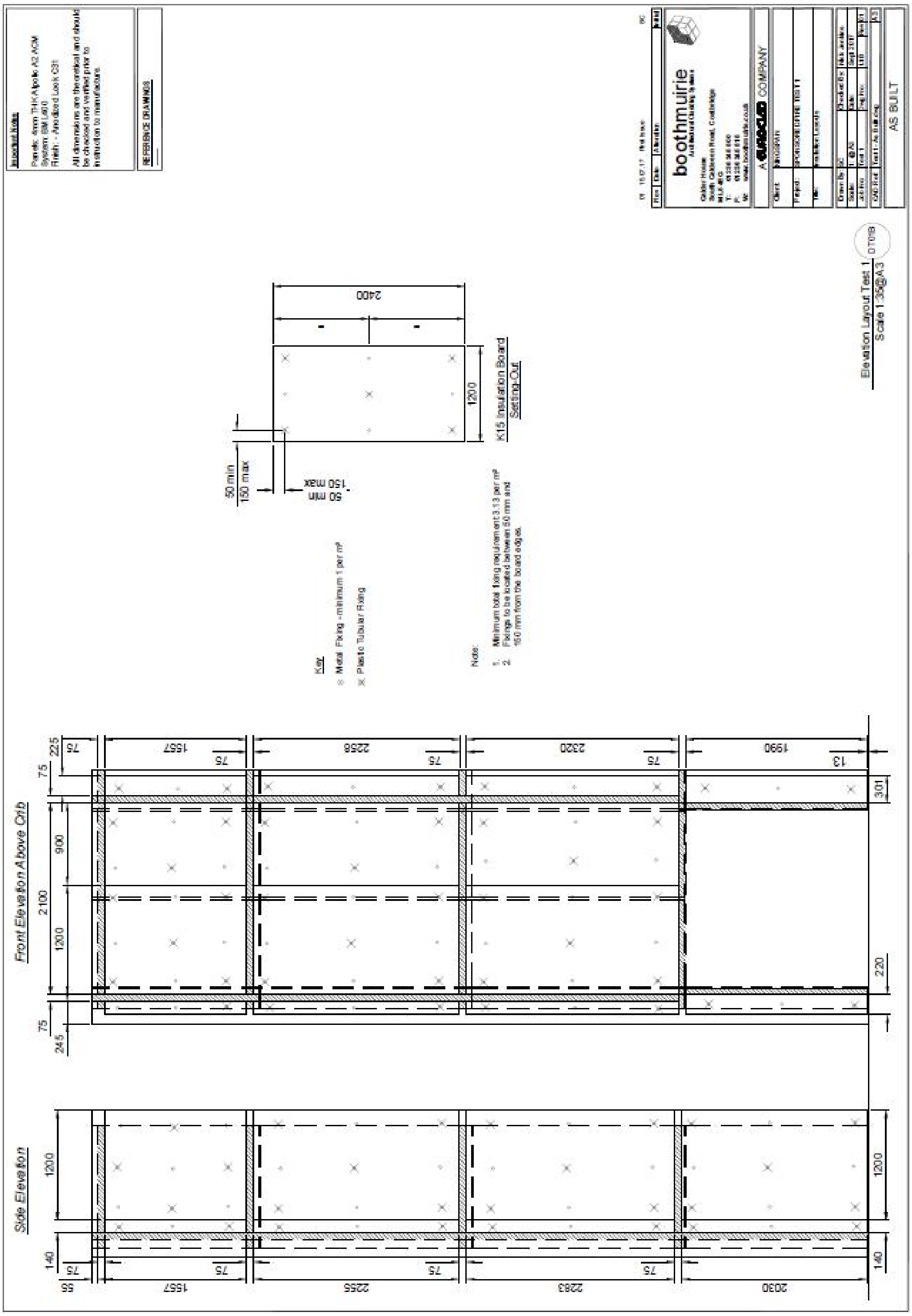

Figure 4. Front elevation, side elevation for the insulation panel installation (supplied by the Test Sponsor).

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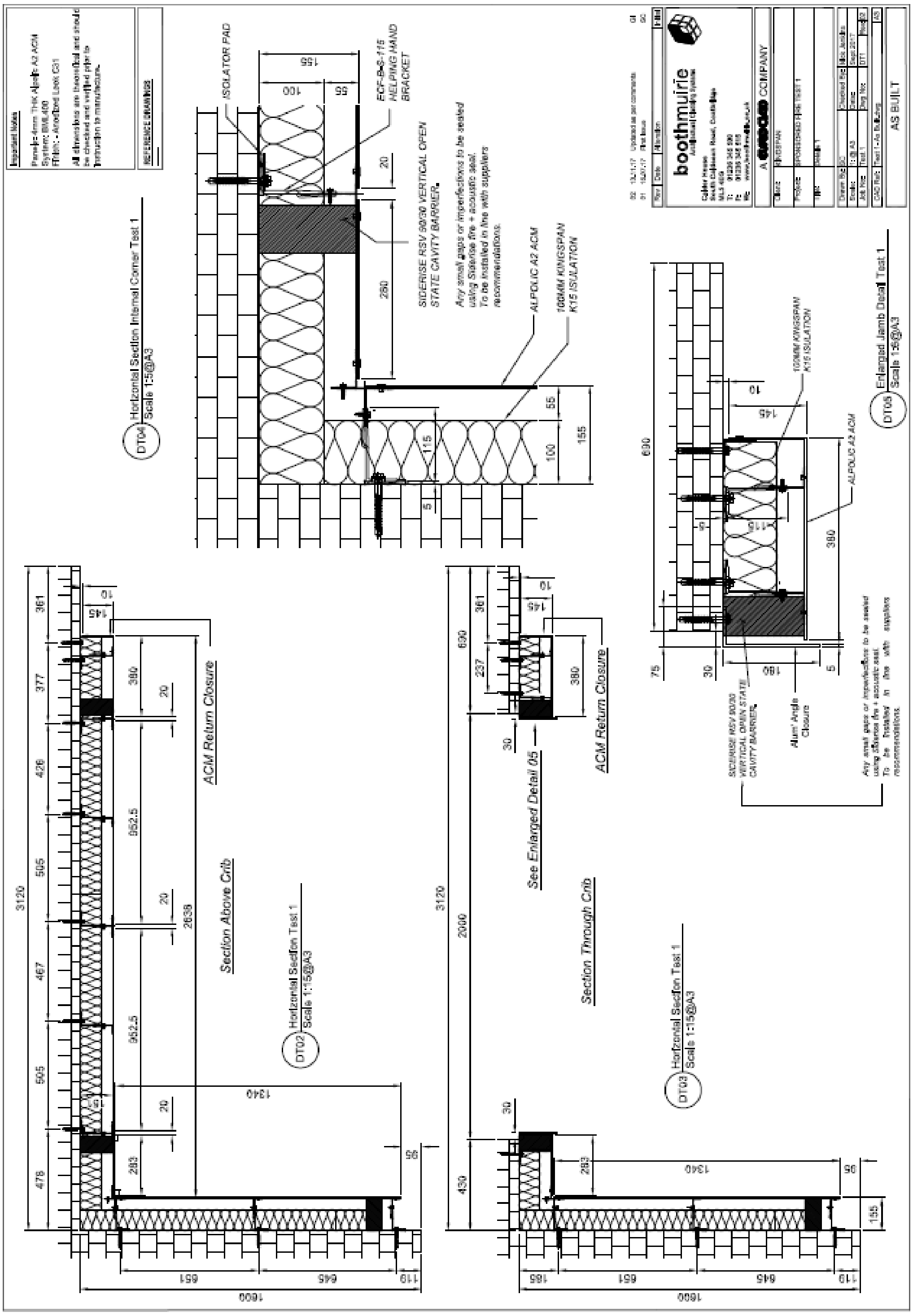

Figure 5 Horizontal section through and above the combustion chamber, and insulation details for tested system (supplied by the Test Sponsor).

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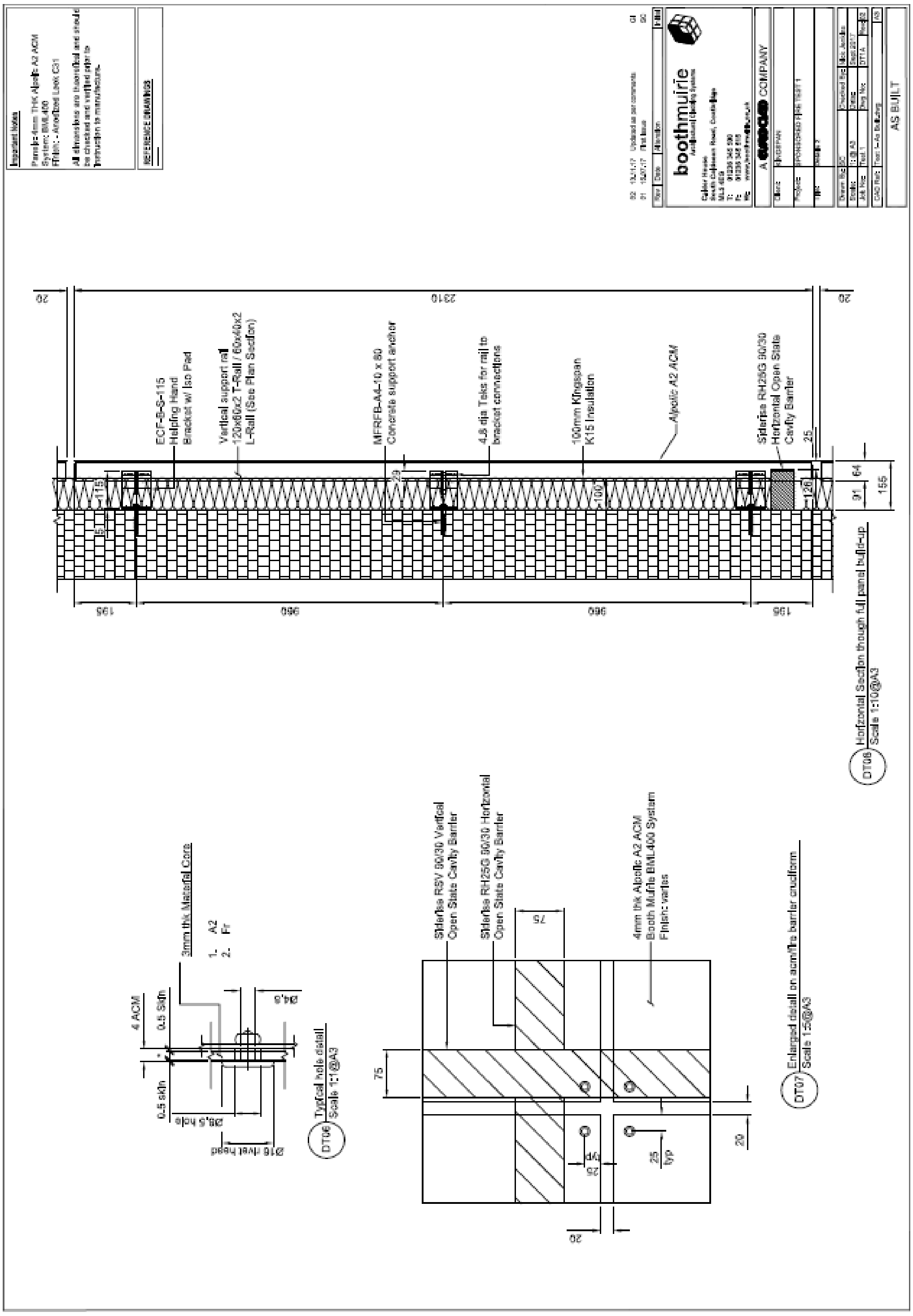

Figure 6 Vertical section through the cladding system, ACM panel detail and vertical and horizontal cavity barriers (supplied by the Test Sponsor).

4 Supporting Evidence

4.1 Test reports

Name of Laboratory	Name of sponsor	Test reports/extended application report Numbers	Test method / extended application rules & date
BRE Global, BRE	Mitsubishi Chemical Corporation	P109971-1000 Issue: 1.0	BS 8414 Part 1:2015 + A1:2017

4.2 Test results

Test method	**Parameter**	**No. tests**	**Results**	
			Fire spread test result time, t_s (min)	**Compliance with parameters in Annex B BR135:2013**
BS 8414 Part 1: 2015 + A1:2017	External fire spread	1	>15 minutes	Compliant
	Internal fire spread		>15 minutes	Compliant

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4.3 Mechanical performance

Burning droplets from the system were observed after 9 minutes from ignition.

Detachment of panel parts (row 1 and row 2) was observed after 10 minutes from ignition.

Flames on the surface of the system were observed (i.e. top edge of panels 2C&2D, joint between 2C&2D and 3C&3D) up to 27 minutes from the time that the fire source has been extinguished.

4.4 System damage

4.4.1 ACM ALPOLIC/A2 panels

Row 0 - Panel 0A sustained significant distortion and discoloration (approximately 90% paint delamination, 10% dark discoloration) Panel 0B sustained discoloration and distortion on the left hand edge of the panel (viewed from the front, adjacent to the combustion chamber). Panel 0E was not significantly damaged.

Row 1 - Panel 1A sustained significant distortion and discoloration (approximately 80% paint delamination, 10% dark discoloration). Panel 1B sustained significant distortion and discoloration (approximately 25% paint delamination, 45% dark discoloration). Panels 1C and 1D were both consumed up to 90%. Panel 1E was not significantly damaged.

Row 2 - Panel 2A sustained distortion and discoloration (<5% paint delamination, <15% dark discoloration). Panel 2B sustained distortion and discoloration (<5%) at the base of the panel, left hand side. Panels 2C and 2D were consumed approximately 25% and sustained damage across the full panels surface. Panel 2E was not significantly damaged.

Row 3 - Panels 3A and 3B sustained minor distortion. Panels 3C and 3D sustained damage at the bottom end (consumption <5%) and distortion. Paint delamination and discoloration was recorded on a surface <10%. Panel 1E was not significantly damaged.

4.4.2 Aluminium rail substructure

The central aluminium ‘T’-shaped rail on the main wall was fully consumed up to a height of approximately 4.6m. Behind panels 3C&3D, the central aluminium rails were intact but discoloured and slightly distorted.

The aluminium brackets situated immediately above the combustion chamber were severely damaged or melted.

Following the removal of the ACM panels from the wing wall the aluminium substructure which held the panels in place did not sustain any visible damage

4.4.3 Thermal insulation (Kingspan K15)

Row 0 - The thermal insulation installed on the wing wall (behind the 0A panel) did not sustain any significant damage. The aluminium foil on the insulation has partially detached but with no visible charring on the surface of the thermal insulation material. No significant damage was recorded on the insulation behind panels 0A (wing wall) and 0E (main wall).

Row 1 - The thermal insulation installed on the wing wall (behind the 1A panel) did not sustain any significant damage. The aluminium foil on the insulation has partially detached but with no visible charring on the surface of the thermal insulation material.

The thermal insulation installed on the main wall (behind the panels 1C and 1D) directly above the combustion chamber was charred up to 95% of the volume. In some areas (approximately 15-20%) the masonry support structure is visible.

The thermal insulation installed on the main wall (behind the panels 1B and 1E) did not sustain any significant damage on the surface.

Row 2 - The thermal insulation installed on the wing wall (behind the 2A panel) did not sustain any significant damage.

The thermal insulation installed on the main wall (behind the panels 2C and 2D) was charred up to 90% from the surface. In some areas (<5%) the masonry support structure is visible.

The thermal insulation installed on the main wall (behind the panels 2B and 2E) did not sustained any significant damage on the surface.

Row 3 - The thermal insulation installed on the wing wall (behind the A panel) did not sustain any significant damage.

The thermal insulation installed on the main wall (behind the panel 3C) was charred up to 50% from the surface. Behind the panel 3D the insulation was charred up to 90% from the surface.

The thermal insulation installed on the main wall (behind the panels 3B and 3E) did not sustain any significant damage on the surface.

4.4.4 Horizontal cavity barriers (Siderise RH25G 90/30)

The horizontal cavity barrier at the base of level 1 panels (between the vertical cavity barriers, directly above the combustion chamber) was partially detached during the fire exposure. It can be observed that the intumescent material reacted on the entire length of the cavity barrier positioned on the wing wall.

A 1000mm-long section of horizontal cavity barrier had detached at the base of the second row panels beneath panel 2D.

A 500mm-long section of horizontal cavity barrier had detached at the base of the third row panels beneath panels 3C&3D.

4.4.5 Vertical (compression) cavity barriers (Siderise RSV90/30)

The fire damage to the cladding system on the main wall was contained within the bounds of the vertical cavity barriers across the combustion chamber opening. The cavity barriers remained intact despite significant charring and discolouration along the inside edges running parallel to the vertical edges of the combustion chamber.

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5 Classification and field of application

5.1 Reference of classification

This classification has been carried out in accordance with Annex A of BR 135 – 'Fire performance of external thermal insulation for walls of multi-storey buildings.' Third Edition 2013.

5.2 Classification

The system described in this classification report has been tested and met the performance criteria set in Annex A of BR 135:2013.

5.3 Field of application

This classification is valid only for the system as installed and detailed in Section 2 of this classification report and the associated details found in the related test reports, referenced in Section 4.

6 Limitations

This classification document does not represent type approval or certification of the product.

The classification applies only to the system as tested and detailed in the classification report. The classification report can only cover the details of the system as tested. It cannot state what is not covered. When specifying or checking a system it is important to check that the classification documents cover the end-use application.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons, it is recommended that the relevance of test and classification reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test or classification to ensure that they are consistent with current practices, and if required may endorse the report.

7 References

1 BS 8414-1:2015 + A1:2017, 'Fire performance of external cladding systems – Part 1: Test method for non-load bearing external cladding systems applied to the masonry face of the building', British Standards Institution, London, 2015.

2 BRE Test report P110396-1000. BS EN ISO 1716 Gross heat of combustion (calorific value).

Report Ends