

## Fire Performance Testing of an External Cladding System BS 8414-2:2015 + A1:2017

### Test Report

Prepared for : Kingspan Insulation Ltd.  
Project : System Development  
Report No. : DLR1515 Rev.0  
Sample : 100mm Kingspan Kooltherm K15 - Alpollic A2 ACM -  
BML400



4559

August 2018

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## 1. Introduction

This report describes the fire performance test carried out at Al Futtaim Exova (AFE) laboratory in Dubai at the request of:

Kingspan Insulation Ltd.,  
Pembroke, Leominster,  
Herefordshire, England.

Client contact: [highrisetechnical@kingspan.com](mailto:highrisetechnical@kingspan.com) Contact number: +44 1544 387 382

AFE Job/Sample Number: PD 106193 / C2753E

The test sample consisted of external wall cladding system (100mm Kingspan Kooltherm K15 – Alpollic A2 ACM – BML400) installed by European Aluminium Systems on behalf of Kingspan Insulation Ltd.

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### 1.1 Purpose of Testing

The test was carried out on 30<sup>th</sup> April 2018 to determine the fire performance of a cladding panel system fixed on to steel frame substrate when exposed to external fire under controlled conditions. The test method was in accordance with AFE test method statement DMC2753E/MSrev0, which was in accordance with the following standards:

- ▶ BS 8414-2: 2015 + A1:2017

This test report relates only to the actual sample as tested and described herein.

The tests were witnessed wholly or in part by:

Adam Heath	-	Kingspan Insulation Ltd.
Janet Murrell	-	Exova Warrington
Mostafa Jafarian	-	Exova Warrington

The test was supervised and conducted by Arun Kumar Murugan of Al Futtaim Exova.



## 1.2 Terms and Definitions

### 1.2.1 Level 1 Height

2500mm above the top of the combustion chamber opening on the test apparatus.

Refer to section 4 for details.

### 1.2.2 Level 2 Height

5000mm above the top of the combustion chamber opening on the test apparatus.

Refer to section 4 for details.

### 1.2.3 Start Temperature, $T_s$

Mean temperature of the thermocouples at Level 1, five minutes prior to ignition of the heat source.

### 1.2.4 Start Time, $t_s$

Time when the temperature recorded by any external thermocouple at Level 1 equals or exceeds 200°C above  $T_s$  and remains above this value for at least 30 seconds.

## 2. Test Summary

The cladding system was tested in accordance with BS 8414-2:2015 + A1:2017.

**The test was terminated early as the flames reached above the test sample within 27 minutes from the time of ignition.**

See Figure 3 on page 13 and Figure 4 on page 14 for the thermocouple locations & numbers.

**Table 1 Observations**

Parameters	Temperature Data / Observations
T <sub>s</sub> , start temperature	29°C
t <sub>s</sub> , start time	117 seconds after ignition of the crib (thermocouple 3)
Peak temperature & time at Level 2 (External)	803°C at 1214 seconds from t <sub>s</sub> (thermocouple 11)
Peak temperature / time at Level 2 (Mid-depth of cavity)	889°C at 1388 seconds from t <sub>s</sub> (thermocouple 19)
Peak temperature / time at Level 2 (Mid-depth of 100mm Kingspan Kooltherm K15 insulation)	305°C at 1169 seconds from t <sub>s</sub> (thermocouple 27)
Peak temperature / time at Level 2 (Mid-depth of 12mm Versapanel Cement Particle Board)	117°C at 1012 seconds from t <sub>s</sub> (thermocouple 38)
Peak temperature / time at Level 2 (Mid-depth of 100mm SFS)	58°C at 1015 seconds from t <sub>s</sub> (thermocouple 46)
Peak temperature / time at Level 2 (Mid-depth of 2 layers of 12.5mm Plaster Board)	61°C at 1400 seconds from t <sub>s</sub> (thermocouple 56)

For full details refer to Section 6.

The above results are valid only for the conditions under which the tests were conducted.

### 3. Description of the Test Sample

The test specimen build up comprised of:

- ❖ 2 layers of 12.5mm plaster boards.
- ❖ Kingframe SFS (steel framing system)
- ❖ 12mm thick Versapanel cement particle board
- ❖ Siderise RH25G 90/30 horizontal open state cavity barrier.
- ❖ Siderise RSV-90/30 vertical cavity barrier.
- ❖ 100mm Kingspan Kooltherm K15 insulation.
- ❖ Galvanized steel 'C' channel
- ❖ ECF-B-S-220 Helping Hand bracket.
- ❖ Aluminium 'T' rail and 'L' rail.
- ❖ 4mm thick Alpolic A2 composite panel.

The sample dimensions were:

Main wall - 2668 wide x 8476mm high.

Wing wall -1340mm wide x 8476mm high.

The top termination of the cladding system was closed with 2mm thick aluminium sheet. The main wall side was partially closed with aluminium composite panel folded inwards. Wing wall side was left open. The interface between the cladding system and the combustion chamber was covered with 5mm thick aluminium pod. The distance of the finished face of the wing wall to the side opening of the combustion chamber was 295mm.

Photo DLP C2753E/0369 below shows an external view of the sample.



Figure 1 Photo DLP C2753E/0369 External View of the Test Sample



The system components are mentioned in Table 2. Refer to the drawings in Appendix B for sample construction details and dimensions.



Table 2 System Details

Component	Description	Installation Details
Internal wall board	2 layers of 12.5mm plaster board.	Plaster boards were fixed to the SFS with flat head screws.
Steel framing system (SFS)	Kingframe SFS (steel framing system) comprising Galvanized cold formed steel 'C' and 'U' sections with 100x50mm studs.  See photos DLP C2753E/0260 & DLP C2753E/0264 in Appendix A.	The tracks were fixed to the concrete beams with HTF-6.3 x 45mm carbon steel screws.  The studs were fixed to the tracks with DF3-SS-5.5x55mm carbon steel screws.
Sheathing board	12mm thick Versapanel cement particle board manufactured by Euroform.  See photo DLP C2753E/0282 in Appendix A.	Cement particle boards were fixed to the SFS with DF3-CF-5.5x22mm carbon steel screws.
Breather membrane	Nilvent breathable membrane.  See photo DLP C2753E/0291 in Appendix A.	Nilvent breathable membrane was provided to the face of the cement board.
Bracket and Railings	<b>'C' channel:</b> Galvanized steel horizontal 'C' channel.  <b>Helping Hand bracket:</b> ECS-B-S-115 Helping hand bracket with 100-HR25 Polypropylene isopad  <b>Railings:</b> 120x60x2mm aluminium vertical T-rail 60x40x2mm aluminium vertical L-rail  See photos DLP C2753E/0291 & DLP C2753E/0297 in Appendix A.	Horizontal 'C' channel brackets were fixed to the SFS through the sheathing board with DF3-SS-5.5x35mm steel screws.  Helping Hand brackets were fixed to SFS through the sheathing board with DF3-SS-5.5x35mm steel screws.  Vertical railings were fixed to the Helping hand bracket with 4.8mm tek screws.
Cavity barrier	<b>Horizontal cavity barrier:</b> Siderise RH25G-90/30, open state cavity barrier, 125mm in depth (25mm closure)  See photos DLP C2753E/0382 & DLP C2753E/0324 in Appendix A.	The horizontal cavity barriers were fixed to the concrete slab with HTF-6.3 x 45mm carbon steel screws and to the sheathing board with DF3-SS-5.5x35mm steel screws.  4 nos. of horizontal cavity barriers were installed on the main wall and wing wall at 25mm, 2375mm 4725mm and 6395mm above combustion chamber.

	<b>Vertical cavity barrier:</b> Siderise RSV-90/30 vertical cavity barrier, 160mm depth.  See photos DLP C2753E/0382 & DLP C2753E/0324 in Appendix A.	The vertical cavity barriers were fixed to the SFS through the sheathing board with DF3-SS-5.5x35mm steel screws.  2 nos. of vertical cavity barrier were installed on the main wall and 1 no. of vertical cavity barrier was installed on the wing wall.
Thermal Insulation	100mm thick Kingspan Kooltherm K15 insulation.  See photo DLP C2753E/0382 in Appendix A.	Kingspan Kooltherm K15 insulation was fixed to the sheathing boards with plastic and steel pins.  Self-adhesive foil tape was provided at the joints, perimeter of the insulation boards.
Panels	4mm thick Alpolic A2 composite panel. Top – Aluminium Skin Core – Mineral Filled Core Bottom – Aluminium Skin  See photo DLP C2753E/0351 in Appendix A.	Cladding panels were fixed to the vertical railings with R-SS-LF-4.8x16mm rivets.  10mm joints were provided between the panels.

Material information described in Table 2 is as supplied by Kingspan Insulation Ltd.

AFE was not involved in the design, procurement, installation, specification and verification of the materials / properties or system.

### Sample installation

AFE monitored the installation of the sample based on the drawings supplied by Kingspan Insulation Ltd. which are included in Appendix B of this report. Any deviation of the installation from these drawings were recorded and reported.

Date of installation: 24 to 28 April 2018

Ambient temperature range: 28 - 37°C



## 4. Test Apparatus

### 4.1 Test Rig

The test specimen was installed on a purpose-built test rig constructed by AFE as per the BS 8414-2:2015 + A1:2017 standard.

The test apparatus had a vertical structural steel test frame, with a vertical main test wall and a vertical return wall (wing) at a 90° angle to, and at one side of the main test wall. The main wall was provided with a combustion chamber with an opening of 2000mm x 2000mm. The test facility was capable of enduring the effects of the test procedure without itself suffering undue damage or distortion. The main wall had a width of 3800mm and the wing wall with a width of 2300mm. The total height of the test rig was 9300mm.

Refer to Figure 2 below for a schematic diagram of the test rig.

### 4.2 Heat Source

A timber crib, 1500mm x 1000mm in plane and 1000mm in height, was constructed using Pinus Silvestris softwood sticks as described in BS 8414-2:2015 + A1:2017 with a first layer consisting of 10 long sticks of 1500mm. The next layer consisted of 15 short sticks was evenly distributed to cover an area of 1500mm x 1000mm.

The process was repeated to give a total of 20 layers of sticks, giving a nominal height of 1000mm. The crib was constructed on a solid steel platform positioned 400mm above the floor of the combustion chamber and placed centrally and displaced 100mm from the back wall of the chamber.

The crib was ignited using 16 strips of low density fibreboard, soaked for 5 minutes in 5 litres of white spirit.

### 4.3 Thermocouples

All thermocouples used conformed to BS EN 60584-1:2013, Type K (Chromel / Alumel). The thermocouples were mineral insulated and had a nominal 1.5mm diameter with insulated junctions. Data acquisition was performed at 3 second intervals.

The locations of the thermocouples on the specimen were as shown in Figure 3.

#### 4.3.1 External thermocouples at Levels 1 and 2

Thermocouples were positioned in front of the main test wall face on the centre line and at 500 mm and 1000 mm each side of the centre line of the combustion chamber (five locations). Thermocouples were also positioned in front of the wing test wall face at 150 mm, 600 mm and 1 050 mm from the finished face of the main test wall face (three locations).

#### 4.3.2 Internal thermocouple locations at Level 2

Thermocouples were positioned within each layer (greater than 10mm thick) of the main test wall face on the centre line and at 500mm and 1000mm each side of the centre line of the combustion chamber (five locations). Thermocouples were also positioned within each layer (greater than 10mm thick) of the wing

test wall at 150mm, 600mm and 1050mm from the finished face of the main test wall face (three locations).

#### 4.4 Audio Visual Equipment

A continuous audio-visual record of the condition of the full height of the test faces was taken throughout the period of the test. Both the external and internal faces of the test specimen was monitored.

**Figure 2 Schematic View of the Test Rig**

Note: All dimensions are in mm, the drawing is not to scale

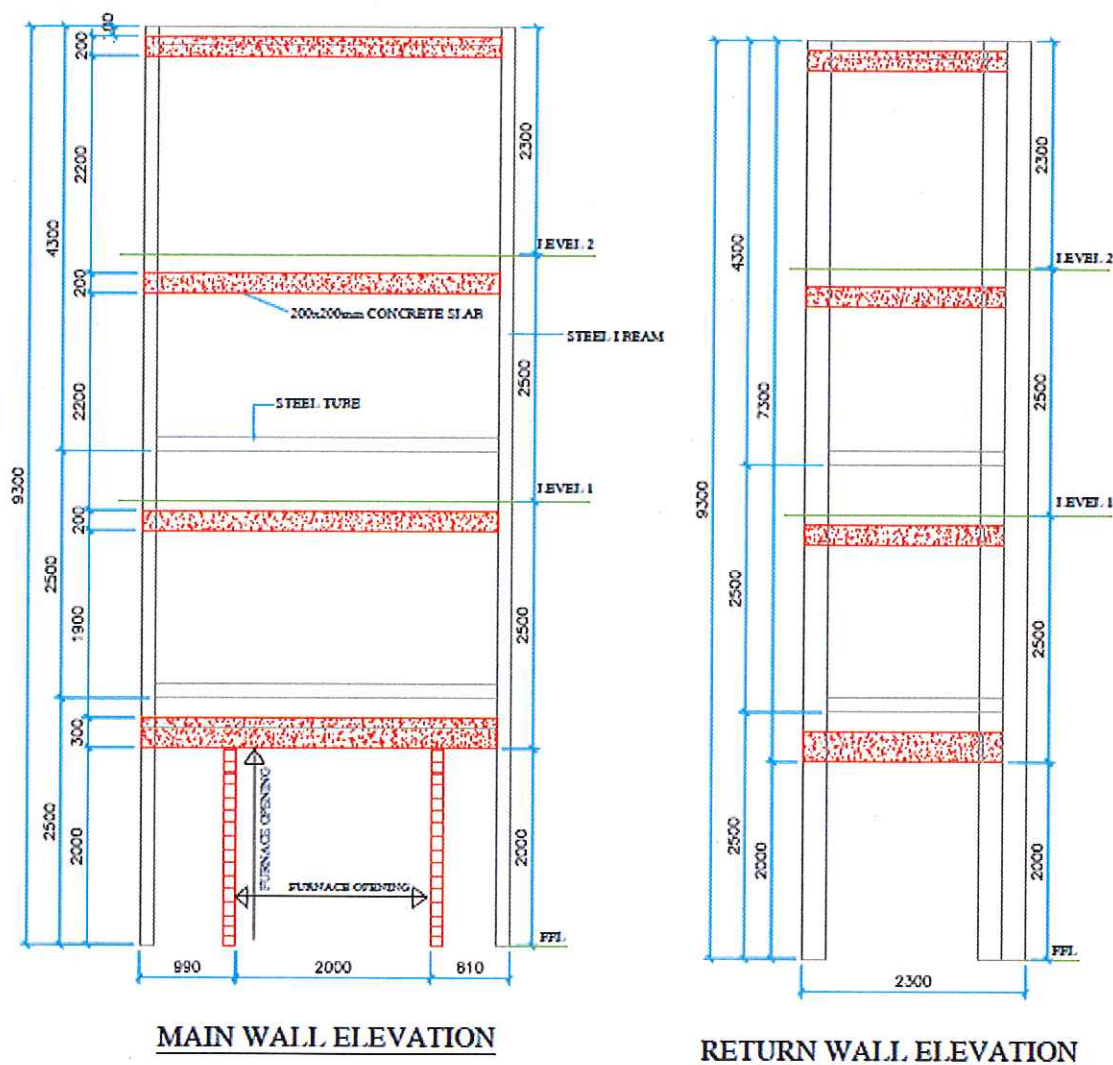




Figure 3 Thermocouple Locations & Panel Numbering

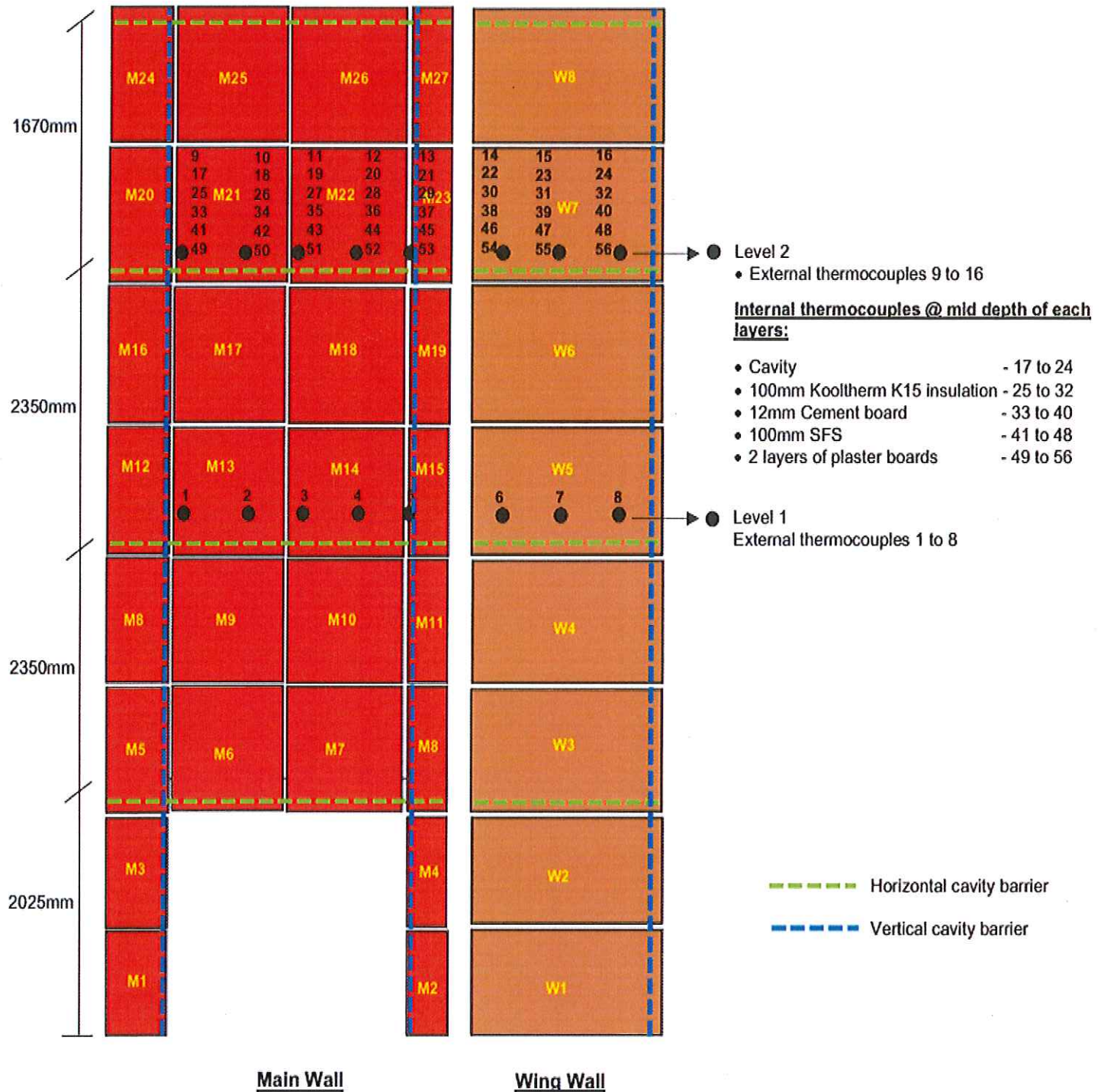
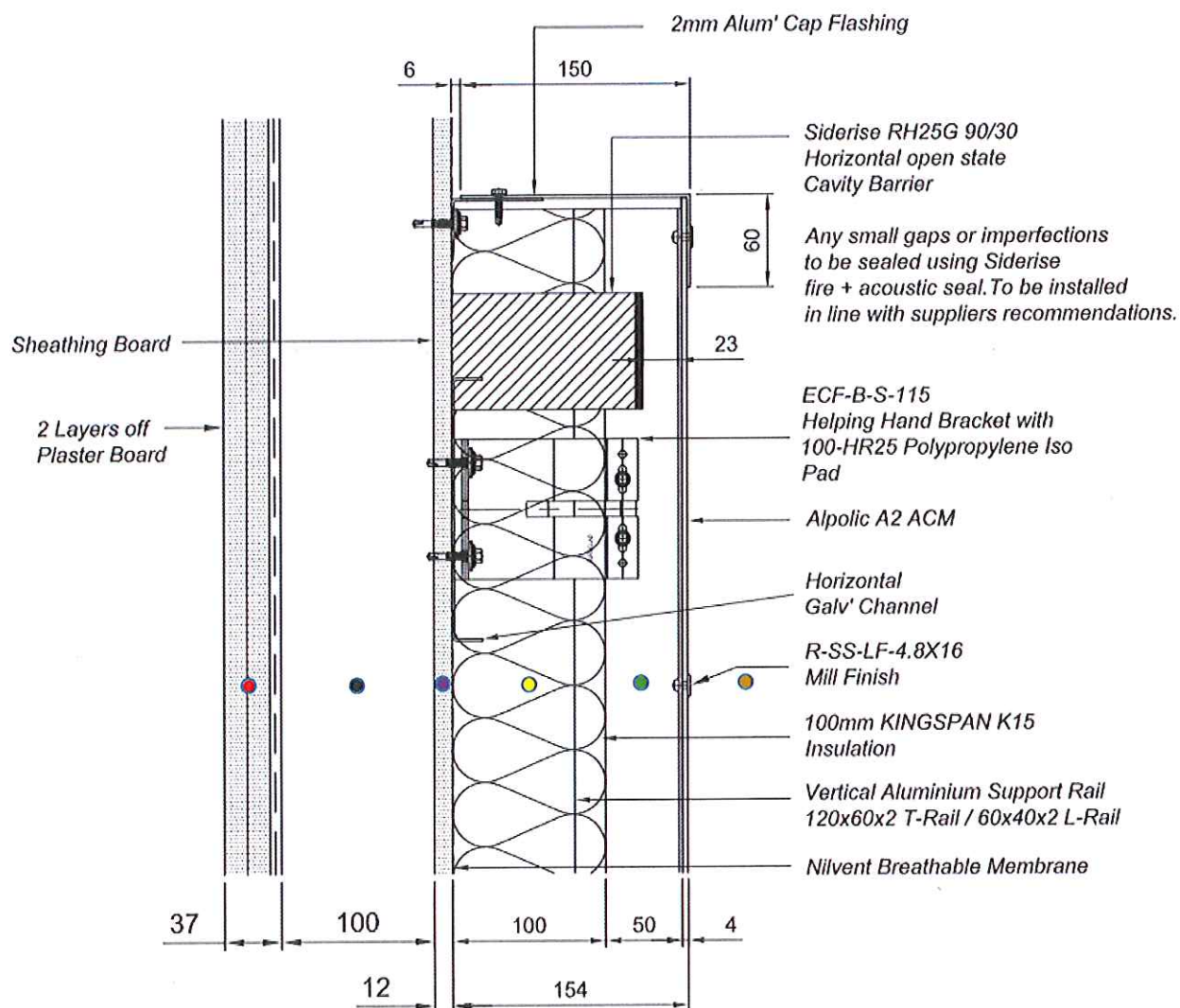


Figure 4 Level 2 Section Drawings Showing the Thermocouple Locations



- |   |            |
|---|------------|
| ● External thermocouples                  | - 9 to 16  |
| ● Cavity                                  | - 17 to 24 |
| ● 100mm Kingspan Kooltherm K15 Insulation | - 25 to 32 |
| ● 12mm Versapanel cement particle board   | - 33 to 40 |
| ● 100mm Kingframe SFS                     | - 41 to 48 |
| ● 2 layers of 12.5mm plaster boards       | - 49 to 56 |

## 5. Test Procedures

### 5.1 Testing

The environmental conditions were recorded.

The data acquisition and video recording was started 5 minutes prior to ignition of the fuel source. Then fuel source was ignited.

Significant events were recorded, including;

- changes in flaming conditions
- change in the mechanical behaviour of the cladding system
- the detachment of any part of the sample
- fire penetration through any fire stops in the cladding system

The heat source was extinguished 30 minutes after ignition. The data acquisition was continued to 60 minutes from ignition.

### 5.2 Post-test Examination

After the test was terminated, the sample was allowed to cool. The sample was then examined for damage, including the following.

- Spalling
- Melting
- Deformation
- Delamination
- The extent of flame spread over the surface of the cladding system
- The extent of flame spread and/or damage within intermediate layers
- An estimate of flame spread and/or damage within cavities
- The extent to which the external face of the cladding system has burnt away or become detached
- Details of any collapse or partial collapse

Smoke staining and discolouration were not considered damage in this context.



## 6. Test Data / Observations

The sample conditioned period was not specified. The ambient temperature was in the range 26°C - 36°C during installation.

Installation start date: 24 April '18

Date of testing: 30 April '18

Ambient temperature: 29°C

Wind speed recorded at the start of the test: 0.25m/s

The table below summarises the observations made during the test.

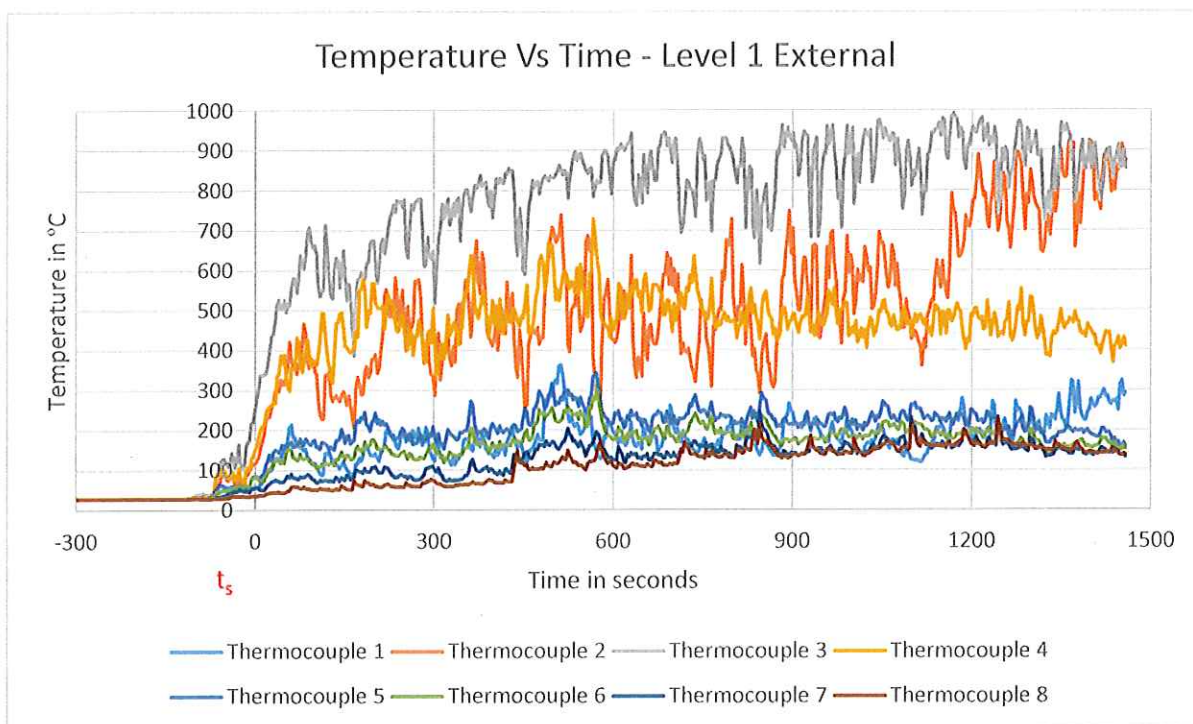
**Table 3 Visual Observations During the Test**

Time	Seconds	Observation	Photo Reference
07:14:10	N/A	Ignition of crib	-
07:15:04	N/A	Flame reached above the combustion chamber.	-
07:16:07	00	Start time $t_s$ , 249°C ( $\geq T_s + 200^\circ\text{C}$ ) at thermocouple 3, Level 1 (main wall).	-
07:17:10	63	Minor buckling on panels M6, M7, M10 & M11.	-
07:17:32	85	Coating of panels M6, M7, M10 & M11 started peeling off.	-
07:18:22	135	Coating of panels M14 & M15 started peeling off.	DLP C2753E/0001
07:19:17	190	Flame tip at 3m above the combustion chamber.	-
07:19:36	209	Minor buckling on panels M14, M15, M18 & M19.	-
07:21:26	319	Flaming debris fell off the main wall.	-
07:22:25	378	Aluminium debris fell off the main wall.	DLP C2753E/0002
07:22:43	396	Aluminium skin of panels M6 & M10 partially melted and insulation behind the panels was burning.	DLP C2753E/0003
07:23:22	435	Aluminium skin of panels M7 & M11 partially melted and insulation behind the panels was burning.	-
07:23:31	444	Continuous falling of flaming debris.	-
07:23:37	450	Flame impinged on wing wall and coating of panel W2 started peeling off.	-
07:24:36	509	Coating of panel W3 started peeling off.	-
07:25:01	534	Flaming debris observed on the floor.	DLP C2753E/0004
07:25:15	548	Flame tip at 5m above the combustion chamber.	-



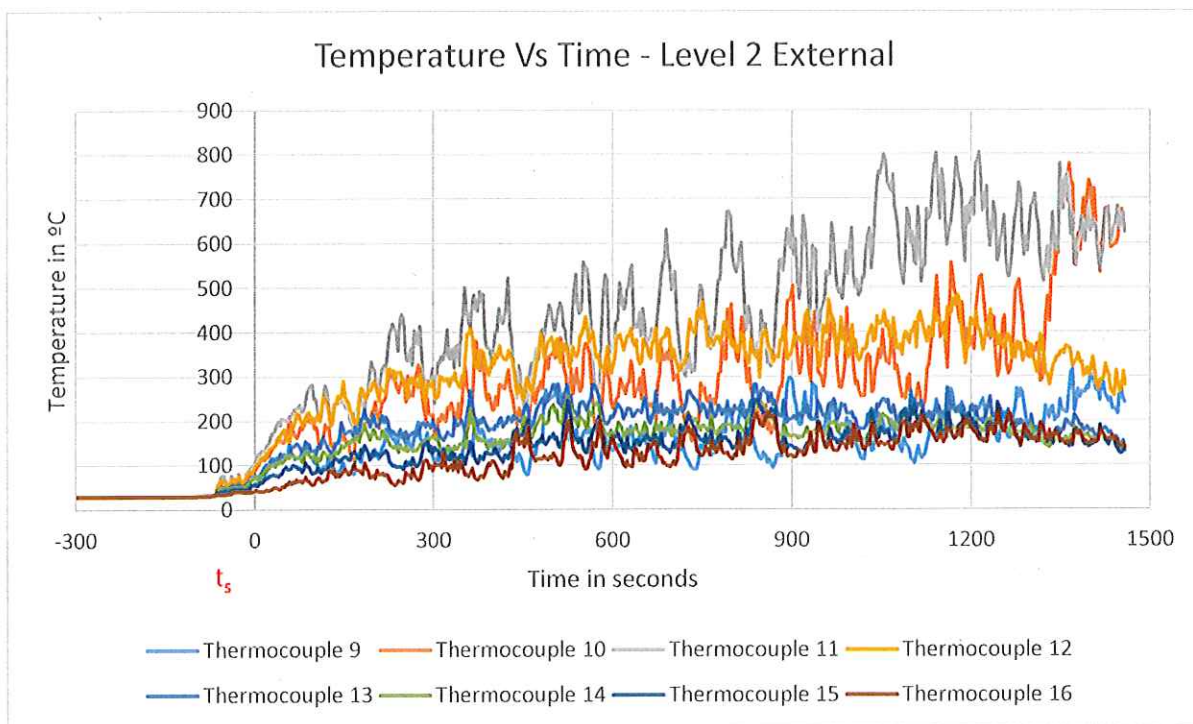
Time	Seconds	Observation	Photo Reference
07:25:31	564	Approximately 50% of panels M6, M7, M10 & M11 melted.	DLP C2753E/0005
07:26:05	598	Debris of insulation fell off the main wall.	-
07:26:58	651	Aluminium skin of panels M14 and M15 partially melted and insulation behind the panels was burning.	-
07:27:07	660	Flaming debris of insulation behind the panel M6 fell off.	DLP C2753E/0006
07:27:22	675	Piece of mineral core of panel M10 fell off.	-
07:27:41	694	Coating of panels M18 & M19 started peeling off.	-
07:27:59	712	Self-sustained flames behind panels M14 & M15.	-
07:28:49	762	Self-sustained flames behind panels M18 & M19.	DLP C2753E/0007
07:29:07	780	Piece of mineral core of panel M19 fell off.	-
07:29:45	818	Debris of panels M18 & M19 fell off.	-
07:30:24	857	Panels M14, M15 and M19 partially consumed and flames on the insulations behind the panels.	DLP C2753E/0008
07:33:39	1052	Coating of panels M22 & M23 started peeling off.	
07:35:12	1145	Aluminium skin of panel M23 started to melt.	
07:35:48	1181	Self-sustained flames at panels M23 & M27 horizontal joint.	DLP C2753E/0009
07:35:59	1192	Continuous falling of debris of aluminium and insulation.	-
07:36:52	1245	Aluminium skin of panel M27 started to melt.	-
07:38:08	1321	Self-sustained flames on the insulations behind panels M23 & M27.	DLP C2753E/0010
07:40:04	1437	Panels M14, M15 and M19 partially consumed and flames behind the panels burning.	-
07:40:40	1473	Flame spread extended above the test apparatus. <b>Test was terminated early.</b>	-
07:42:52	1485	Heat source was extinguished.	-

**Figure 5 Thermocouple Readings on Level 1 - External**



For thermocouple locations see Figure 3 & 4.

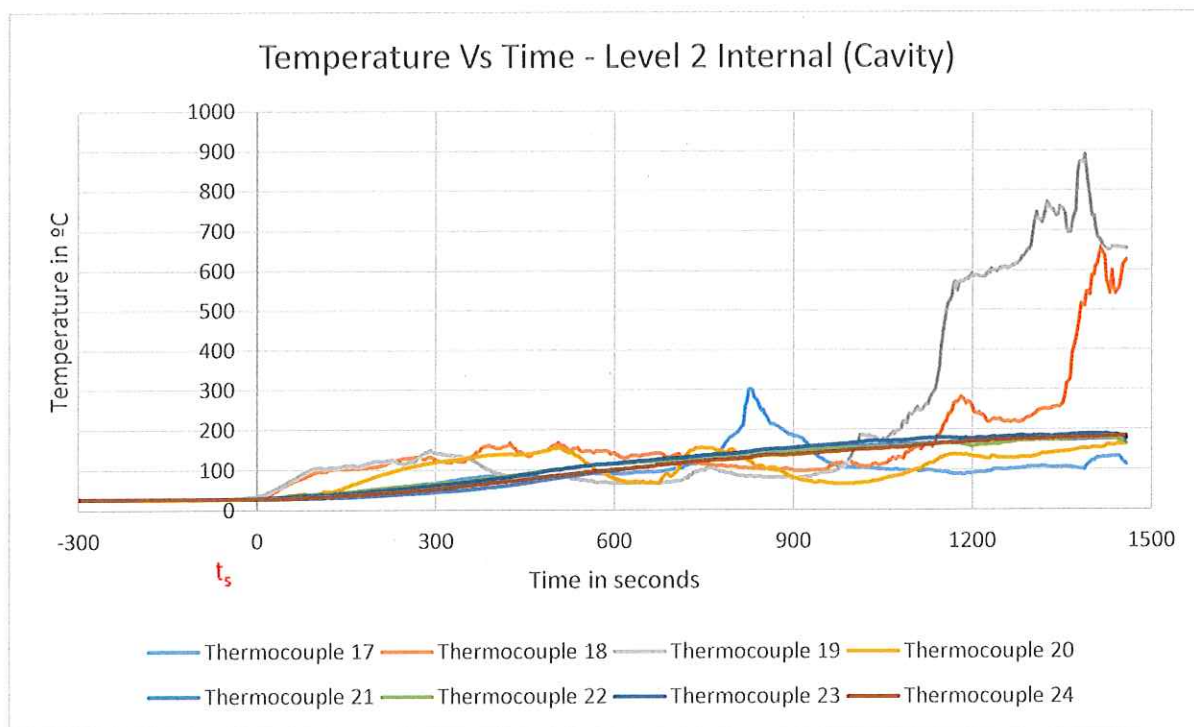
**Figure 6 Thermocouple Readings on Level 2 – External**



For thermocouple locations see Figure 3 & 4.

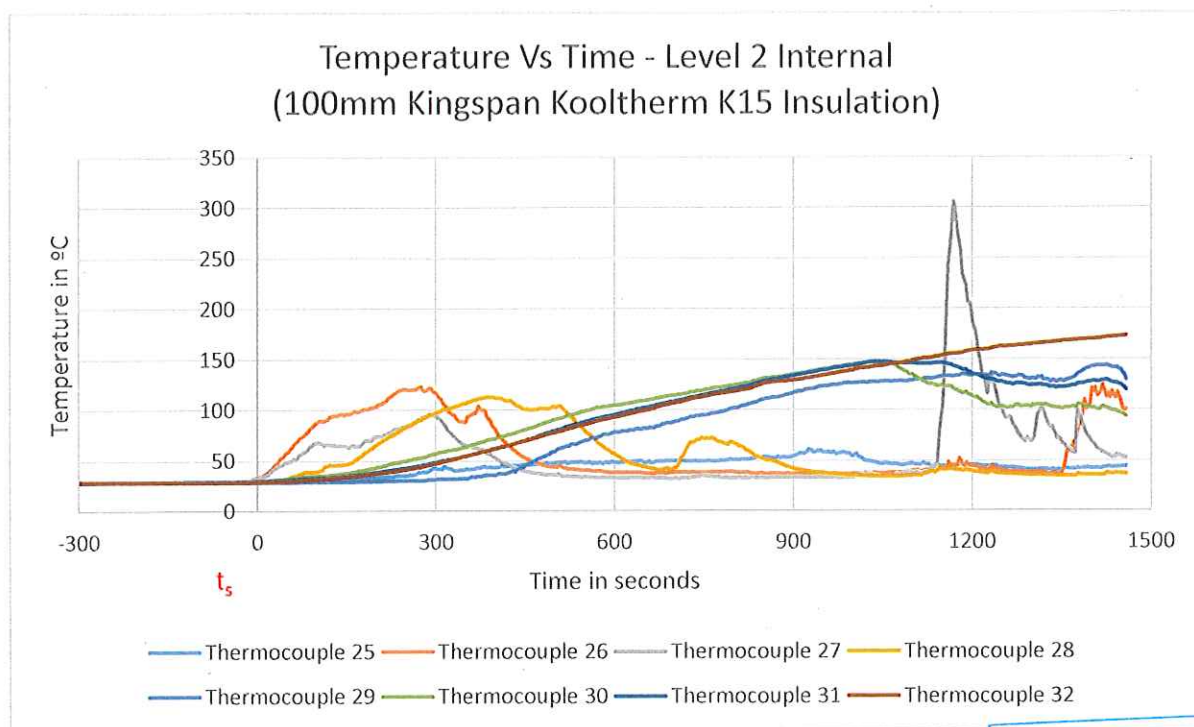


Figure 7 Thermocouple Readings on Level 2 – Internal (Cavity)



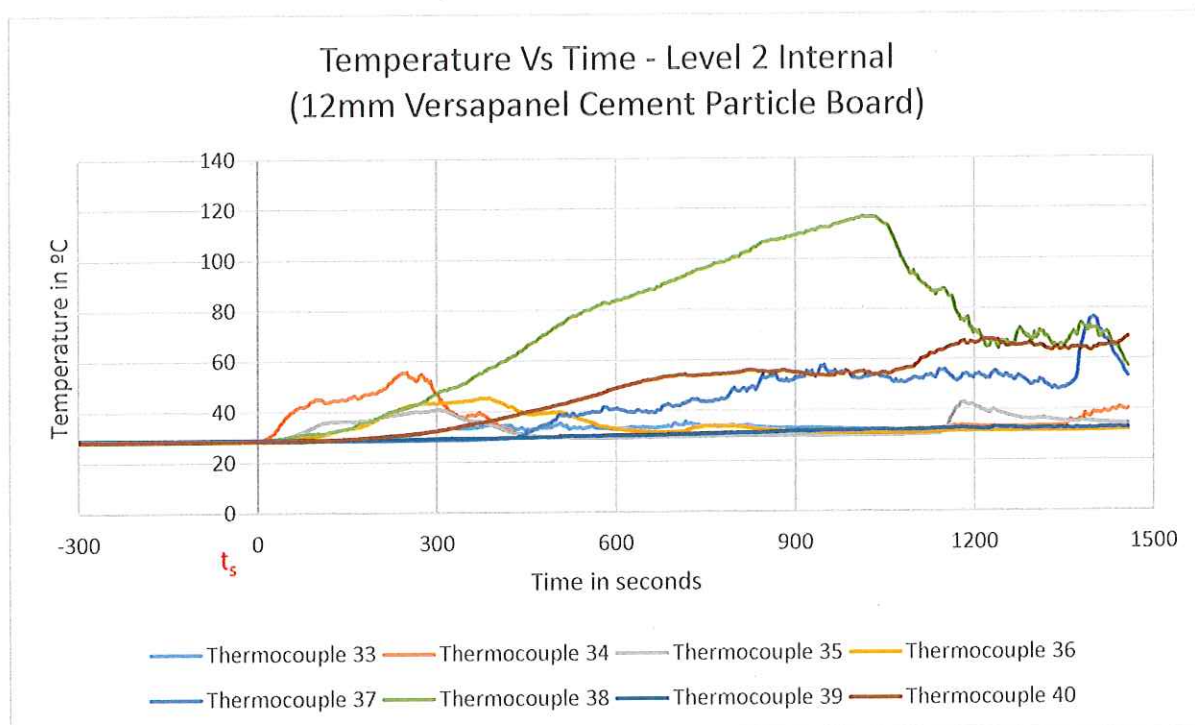
For thermocouple locations see Figure 3 & 4.

Figure 8 Thermocouple Readings on Level 2 – Internal (Mid-depth of 100mm Kingspan Kooltherm K15 Insulation)



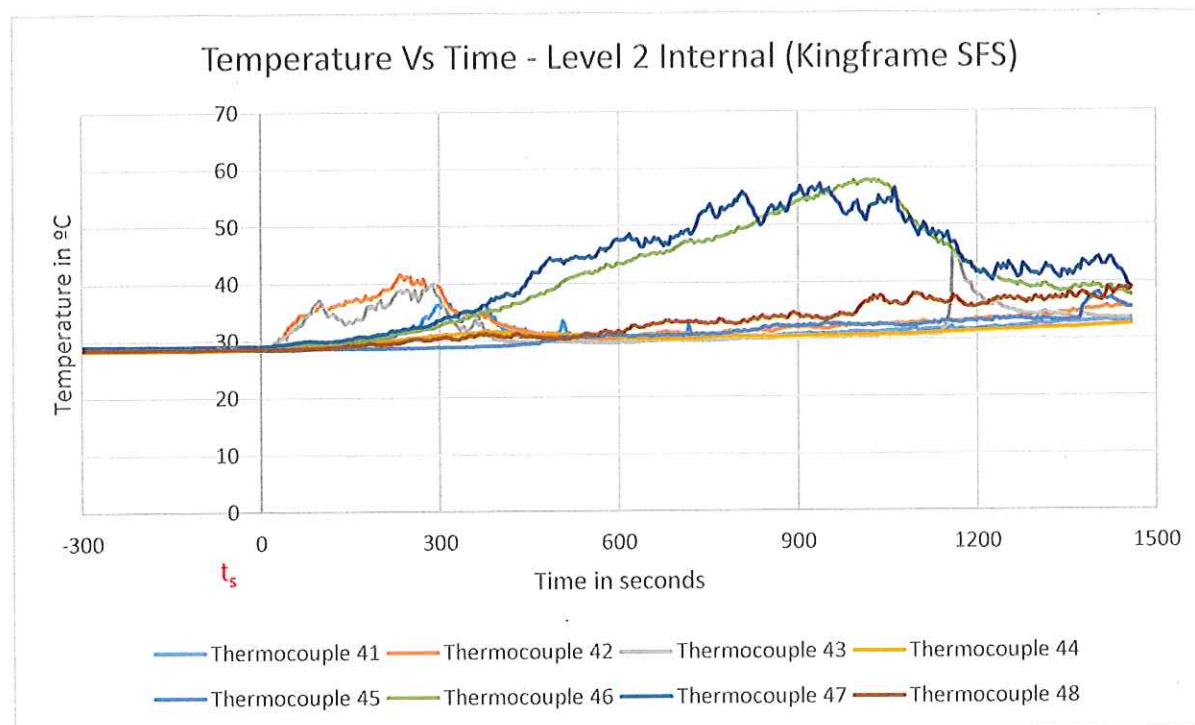
For thermocouple locations see Figure 3 & 4.

**Figure 9 Thermocouple Readings on Level 2 – Internal (Mid-depth of 12.5mm Versapanel Cement Particle Board)**



For thermocouple locations see Figure 3 & 4.

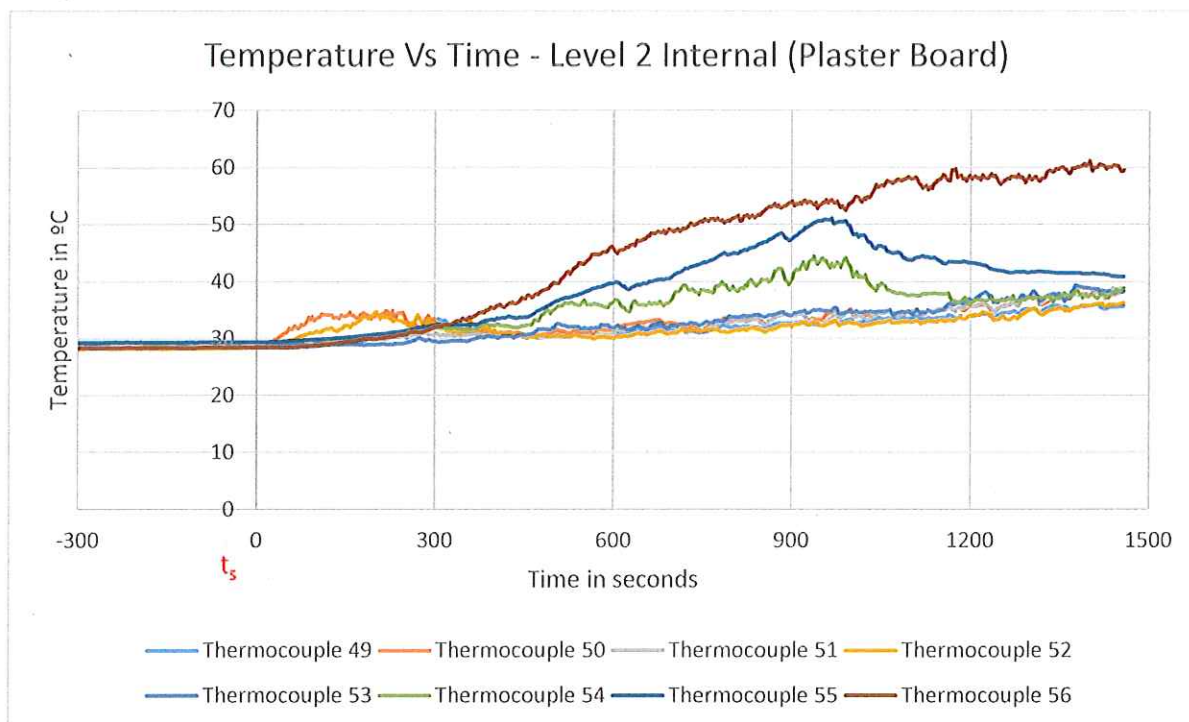
**Figure 10 Thermocouple Readings on Level 2 – Internal (Mid-depth of 100mm Kingframe SFS)**



For thermocouple locations see Figure 3 & 4.



**Figure 11 Thermocouple Readings on Level 2 – Internal (Mid-depth of 2 layers of 12.5mm Plaster Board)**



For thermocouple locations see Figure 3 & 4.

## 6.1 Post-test Examination

Table 4 below summarises the post-test observations.

**Table 4 Post-test Observations**

Sl. No.	Components	Observation	Photo Reference
1	4mm ACM panels	<p>Panels M1, M2, M3, M4, M21, M24, M25 &amp; M28 – No significant changes to the panels.</p> <p>Panels M5, M8, M9, M12, M13, M16, M17 &amp; M20 – Minor buckling and discoloration on the panels.</p> <p>Panel M6, M7, M10 &amp; M14 – Approximately 80% material loss observed. Remaining area was buckled and discoloured.</p> <p>Panels M11, M15, M18 &amp; M19 – Approximately 60% material loss observed. Remaining area was buckled and discoloured.</p> <p>Panels M22 &amp; M23 – Approximately 40% material loss observed. Remaining area was discoloured.</p> <p>Panel M26 – Approximately 50% of the panel was discoloured.</p> <p>Panel M27 – Approximately 25% material loss observed. Remaining area was buckled and discoloured.</p> <p>Panels W1, W2, W3, W4 &amp; W5 – Panels were discoloured.</p> <p>Panel W6 – Approximately 40% of the panel was discoloured.</p> <p>Panels W7 &amp; W8 – No damage to the panels. Minor buckling observed.</p>	DLP C2753E/0011.
2.	Kingspan Kooltherm K15 insulation	<p>Insulation behind the panels M5 was completely burned and fell off.</p> <p>50% insulation behind panels M7, M10, M11, M14 &amp; M18 was completely burned and fell off. Remaining insulation was burned and left as char.</p> <p>50% insulation behind panels M15 &amp; M19, were completely burned and fell off. Remaining insulation was discoloured.</p> <p>50% insulation behind panels M22, M23, M26 &amp; M28 was completely burned and left as char. Remaining insulation was discoloured.</p> <p>All other insulation on the main wall and wing wall was in place and no changes observed.</p>	DLP C2753E/0012 & DLP C2753E/0018.

Sl. No.	Components	Observation	Photo Reference
3.	Cavity barrier	<p><b>Horizontal intumescent cavity barrier:</b></p> <p>Main wall:</p> <p>The 1<sup>st</sup> horizontal cavity barrier at 25mm above the combustion chamber was activated and consumed except the cavity barrier behind panels M5 &amp; M8.</p> <p>The 2<sup>nd</sup> horizontal cavity barrier at 2375mm above the combustion chamber was activated except the cavity barrier behind panels M13 &amp; M16. Intumescent layer was not present during dismantling. Cavity barrier was in place and material loss observed.</p> <p>The 3<sup>rd</sup> horizontal cavity barrier at 4725mm above the combustion chamber was activated except the cavity barrier behind panels M21 &amp; M24. Intumescent layer was partially present during dismantling. Cavity barrier was in place and minor material loss observed.</p> <p>The 4<sup>th</sup> horizontal cavity barrier at 6395mm above the combustion chamber was activated except the cavity barrier behind panels M24 &amp; M28. Intumescent layer was partially present during dismantling. Cavity barrier was in place and minor material loss observed.</p> <p>Wing wall:</p> <p>The 1<sup>st</sup> horizontal cavity barrier at 2025mm above the combustion chamber was not activated. No material loss observed.</p> <p>The 2<sup>nd</sup> horizontal cavity barrier at 4375mm above the combustion chamber was activated. Intumescent layer was not present during dismantling. Cavity barrier was in place and no material loss observed.</p> <p>The 3<sup>rd</sup> horizontal cavity barrier at 6725mm above the combustion chamber was activated. Intumescent layer was not present during dismantling. Cavity barrier was in place and no material loss observed.</p> <p>The 4<sup>th</sup> horizontal cavity barrier at 8395mm above the combustion chamber was activated. Intumescent layer was not present during dismantling. Cavity barrier was in place and no material loss observed.</p> <p><b>Vertical cavity barrier:</b></p> <p>Buckling and discoloration on the vertical cavity barrier on the main wall.</p> <p>No significant changes on the vertical cavity barrier on wing wall.</p>	DLP C2753E/0012, DLP C2753E/0016 & DLP C2753E/0018.



Sl. No.	Components	Observation	Photo Reference
4.	Railings	<p>Railings:</p> <p>Railings behind panels M6, M7, M10, M11, M14, M15, M18 &amp; M19 were melted completely.</p> <p>Railings behind panels M22, M23, M26 &amp; M27 were melted partially. Remaining areas were discoloured and buckled.</p> <p>All other railings on the main wall and wing wall were in place and no damage was observed.</p>	DLP C2753E/0012 & DLP C2753E/0018.
5.	Brackets, galvanized steel 'C' channel and breather membrane	<p>Brackets:</p> <p>Approximately 15% of the Helping Hand brackets on the main wall were partially melted. Remaining brackets were in place. Discoloration and buckling on the aluminium 'C' channels were observed.</p> <p>All the brackets on the wing wall were in place and no damage was observed.</p> <p>Breather membrane:</p> <p>Material loss and discolouration to the Nilvent breathable membrane on the main wall and no significant changes to the Nilvent breathable membrane on the wing wall.</p>	DLP C2753E/0013 & DLP C2753E/0019.
6.	12mm Versapanel cement particle board	Minor damages and discolouration to the Versapanel cement particle board on the main wall and no significant changes to the Versapanel cement particle board on the wing wall.	DLP C2753E/0014 & DLP C2753E/0020.
7.	Kingframe SFS and plaster boards	No significant changes.	DLP C2753E/0015.

## Appendix A

# Photographs

*Note: Any warp in the images is due to fish eye effect of the camera.*

## Pre-test Phase



DLP C2753E/0260 100mm Kingframe SFS





DLP C2753E/0282 12mm Versapanel cement particle board





DLP C2753E/0291 Nilvent breather membrane, galvanized steel 'C' channel and Helping Hand bracket



DLP C2753E/0382      Cavity barrier and Kingspan Kooltherm K15 insulation





DLP C2753E/0264 Kingframe SFS fixing

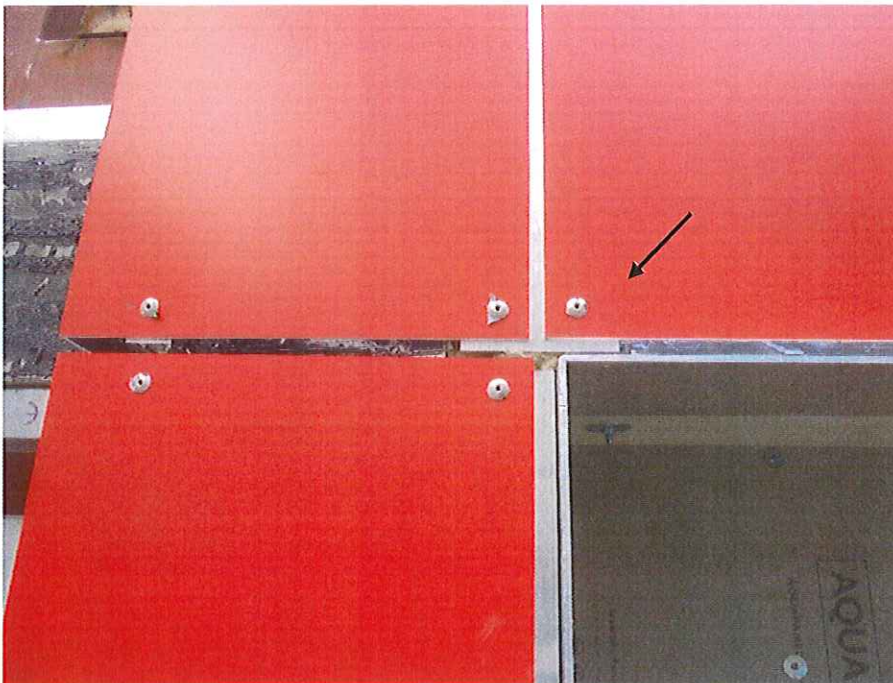


DLP C2753E/0297 Galvanized steel 'C' channel and Helping hand bracket





DLP C2753E/0324 Horizontal intumescent and vertical cavity barrier



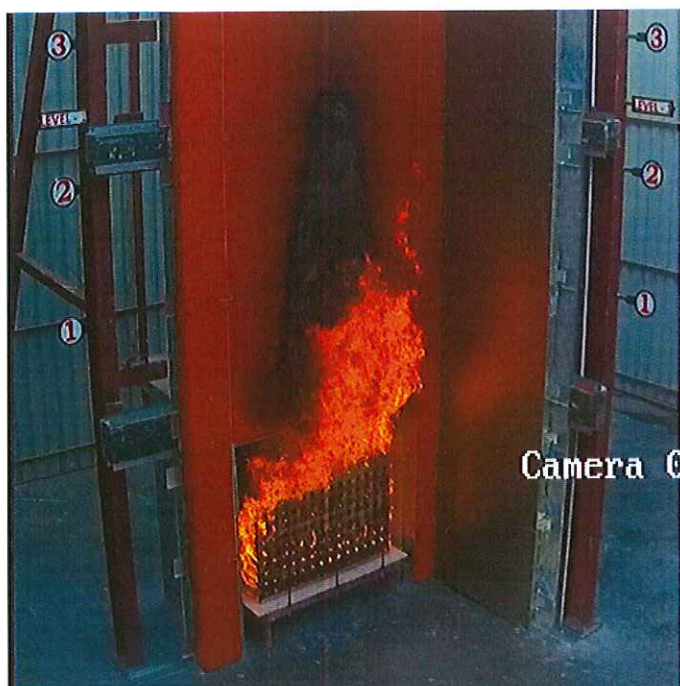
DLP C2753E/0351 ACM panel fixing



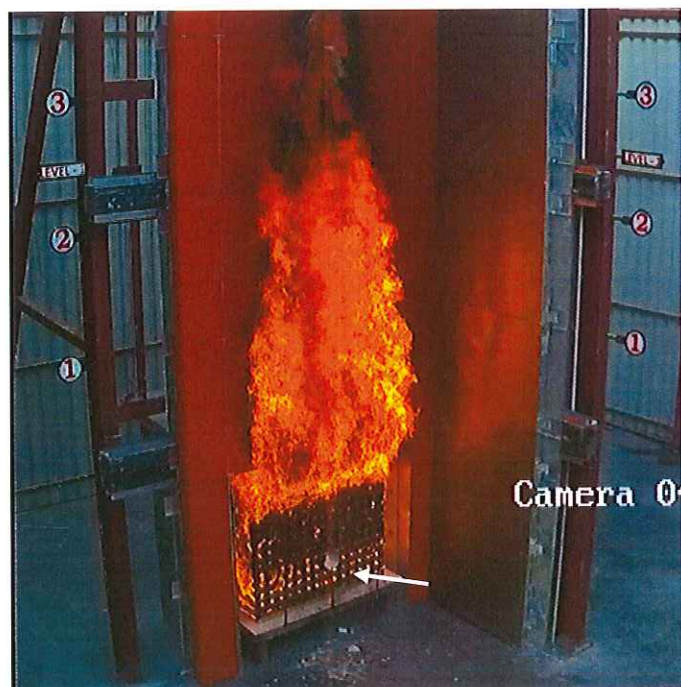
DLP C2753E/0354 Aluminium window pod around the combustion chamber



## Testing Phase

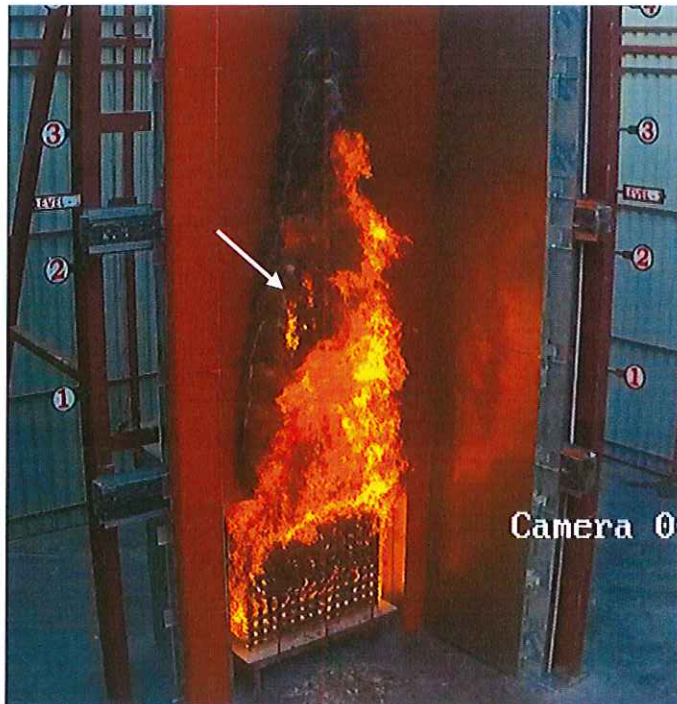


DLP C2753E/0001 Coating of panels M14 & M15 started peeling off.



DLP C2753E/0002 Aluminium debris fell off the main wall.

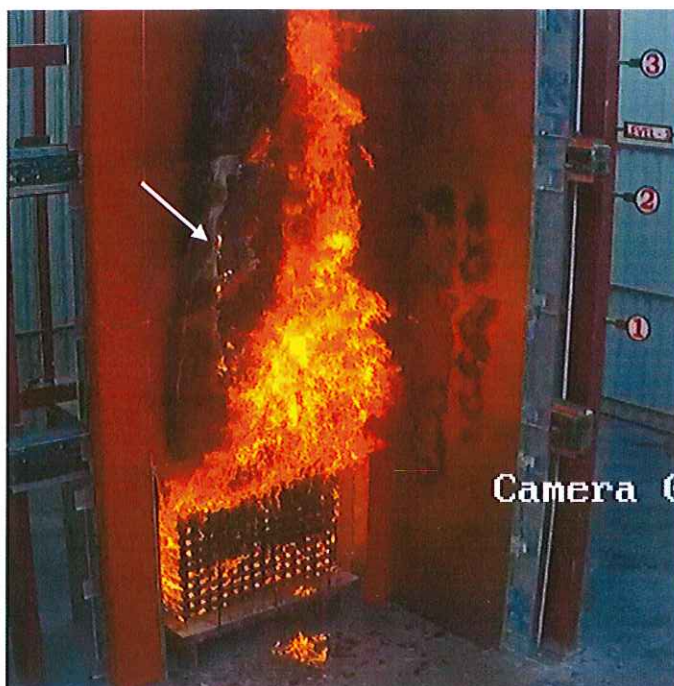




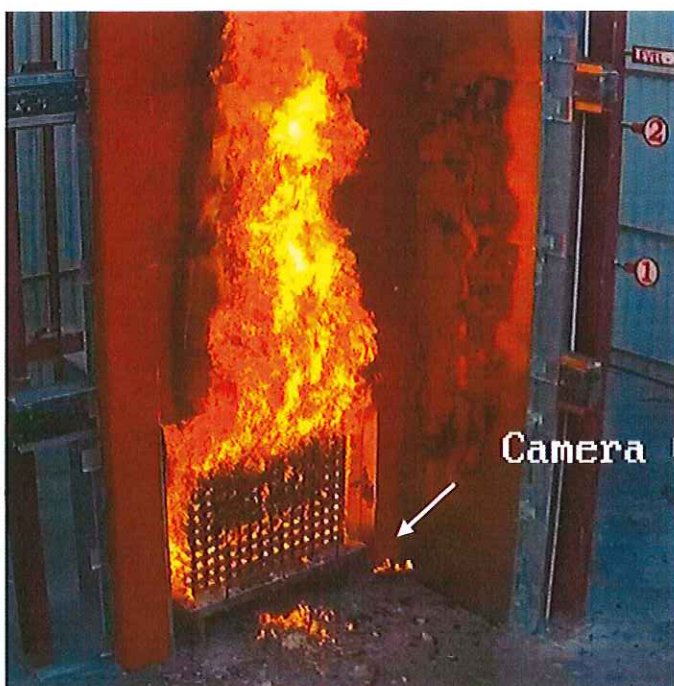
DLP C2753E/0003 Aluminium skin of panels M6 and M10 partially melted and insulation behind the panels burning.



DLP C2753E/0004 Flaming debris observed on the floor.



DLP C2753E/0005 Approximately 50% of panels M6, M7, M10 & M11 melted.

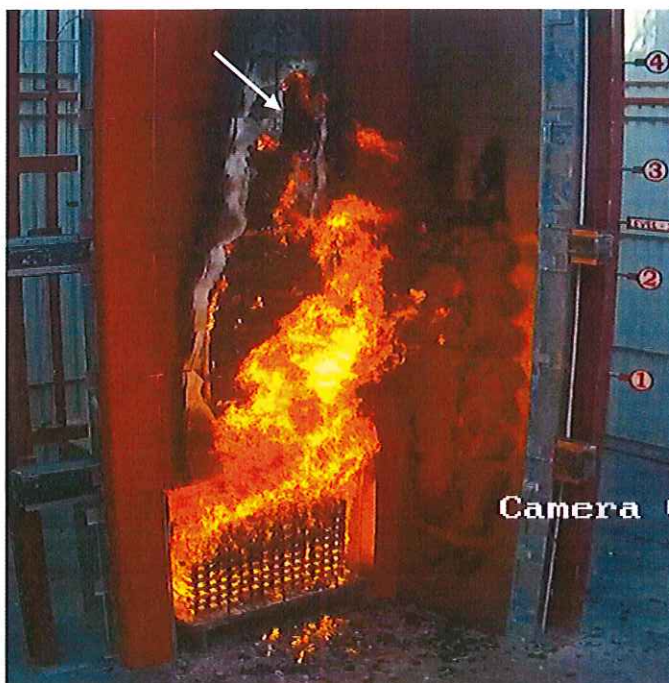


DLP C2753E/0006 Flaming debris of insulation behind panel M6 fell off.



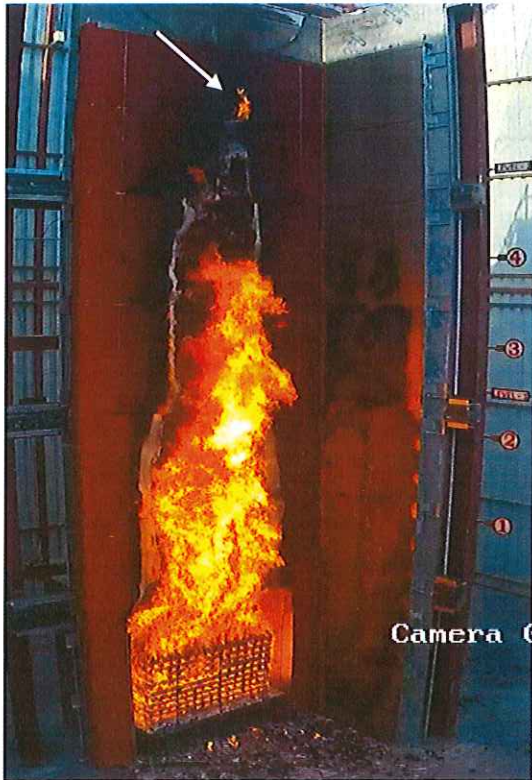


DLP C2753E/0007 Self-sustained flames behind panels M18 & M19.



DLP C2753E/0008 Panels M14, M15 and M19 partially consumed and flames on the insulation behind the panels.





DLP C2753E/0009 Self-sustained flames at panels M23 & M27 horizontal joint.



DLP C2753E/0010 Self-sustained flames on the insulation behind panels M23 & M27.

## Post-Test Phase



DLP C2753E/0011

View of the sample after the test





DLP C2753E/0012

Kingspan Kooltherm K15 insulation, cavity barrier and railings





DLP C2753E/0013

Breather membrane and brackets



DLP C2753E/0014

Versapanel cement particle board





DLP C2753E/0015 SFS and plaster board





DLP C2753E/0016 Cavity barrier at level 1 main wall



DLP C2753E/0017 Vertical cavity barrier





DLP C2753E/0018

Cavity barrier, insulation and railings on wing wall.



DLP C2753E/0019

Brackets



DLP C2753E/0020

Versapanel cement particle board



## Appendix B

# Drawings

The following four un-paginated sheets are copies of Kingspan Insulation Ltd. drawings numbered:

- L7 Rev. 03
- L7A Rev. 04
- DTE Rev. 03
- DT7-2 Rev. 03

# Important Notes

Panels: 4mm THK Alpolic A2 ACM  
System: BML400  
Finish: Silver Met

All dimensions are theoretical and should be checked and verified prior to instruction to manufacture.

## REFERENCE DRAWINGS

SYSTEM: BOOTH MUIRIE BML400 RIVET FIXED-10MM JOINT

INSULATION: 100mm Kingspan K15

CAVITY BARRIER: SIDERISE RSV 90/30 & RH25G 90/30

TEST	ACM	Classification - EN 13501	Screening Results	Finish/Colour
7	Alpolic A2	A2, s1, d0	TBC	Anodized Look C31

DT01 Elevation Layout Test 7 SFS  
Scale 1:40@A3

Rev	Date	Alteration	Initial
04	28.09.19	Updated as per Comments	GI
03	24.04.19	Updated as per Comments	GI
02	12.03.19	Detail Amended	GI
01	01.02.19	Final Issue	GI



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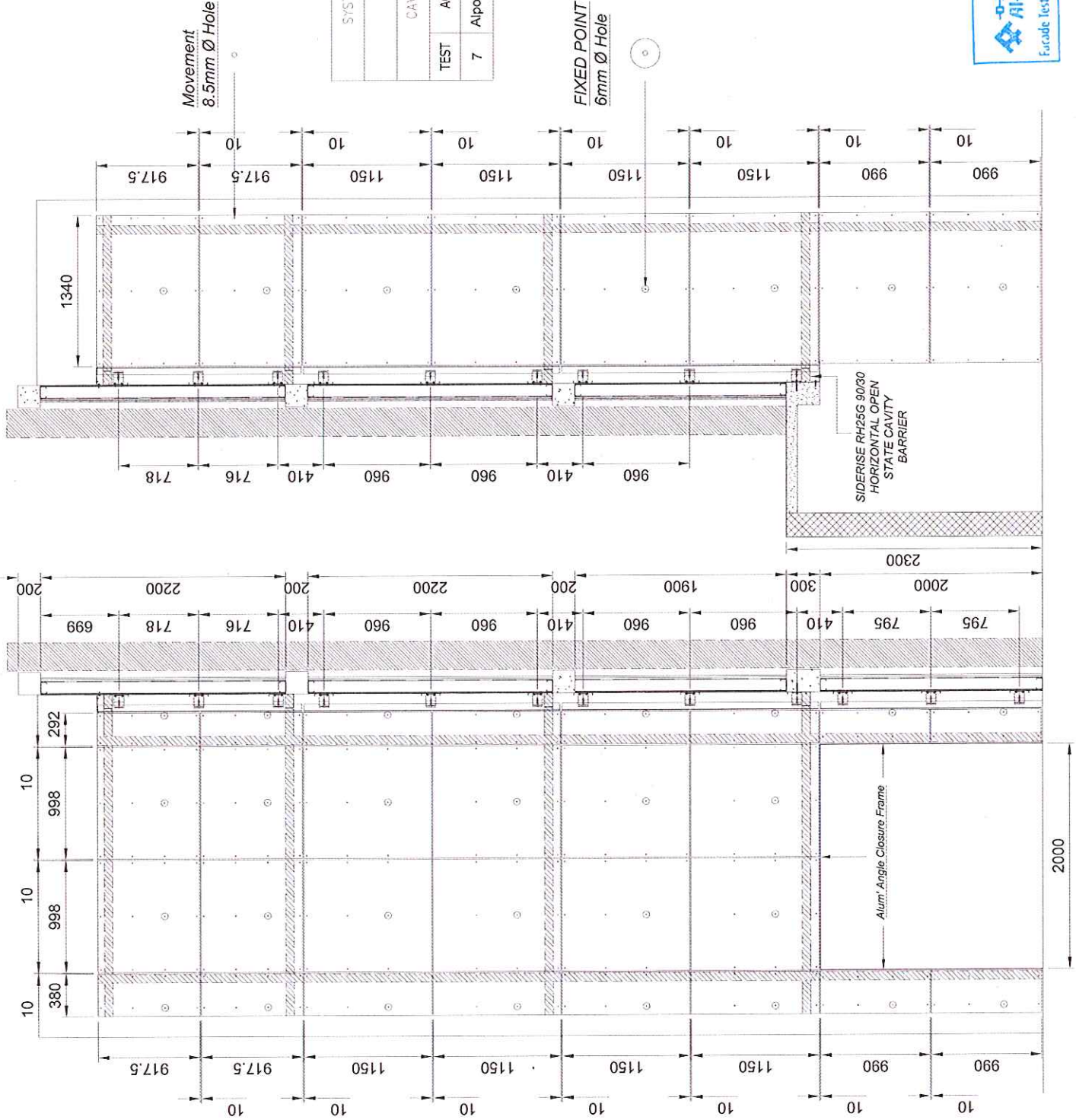
Client: KINGS PAN

Project: Test 7 - BML400 - Alpolic A2 - 10mm joint - K15

Title: Panel Elevations

Drawn By: GI	Checked By: Nick Jenkins
Scale: 1:40 @ A3	Date: Feb 2018
Job No: Test 7 - SFS	Dwg No: L7
CAD Ref: Test 7 C.dwg	Rev: Rev03

FOR APPROVAL



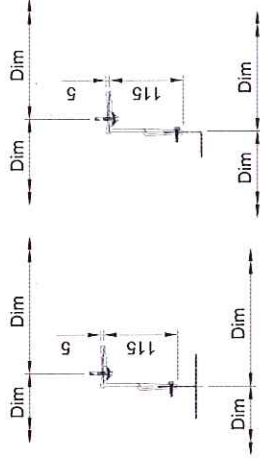


# Important Notes

Panels: 4mm THK Alpolic ACM  
 System: BML400  
 Finish: - Anodized Look C31

All dimensions are theoretical and should  
 be checked and verified prior to  
 instruction to manufacture.

## REFERENCE DRAWINGS



L-Rail

T-Rail

## SET OUT POINTS RAILS/BRACKETS

This Drawing to be read in conjunction with  
 DT-L1 + DT10

Rev	Date	Alteration	Initial
01	20.09.18	Updated as per Comments	GI
02	24.04.18	Updated as per Comments	GI
03	13.03.18	Detail Amended	GI
04	13.11.17	Updated as per comments	GI
05	15.07.17	Final Issue	GI



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 Web: www.boothmuirie.co.uk

Client: KINGS PAN  
 Project: Test 7 - BML400 - Alpolic A2 - 10mm joint - K15  
 Title: Sub-Grid Layouts

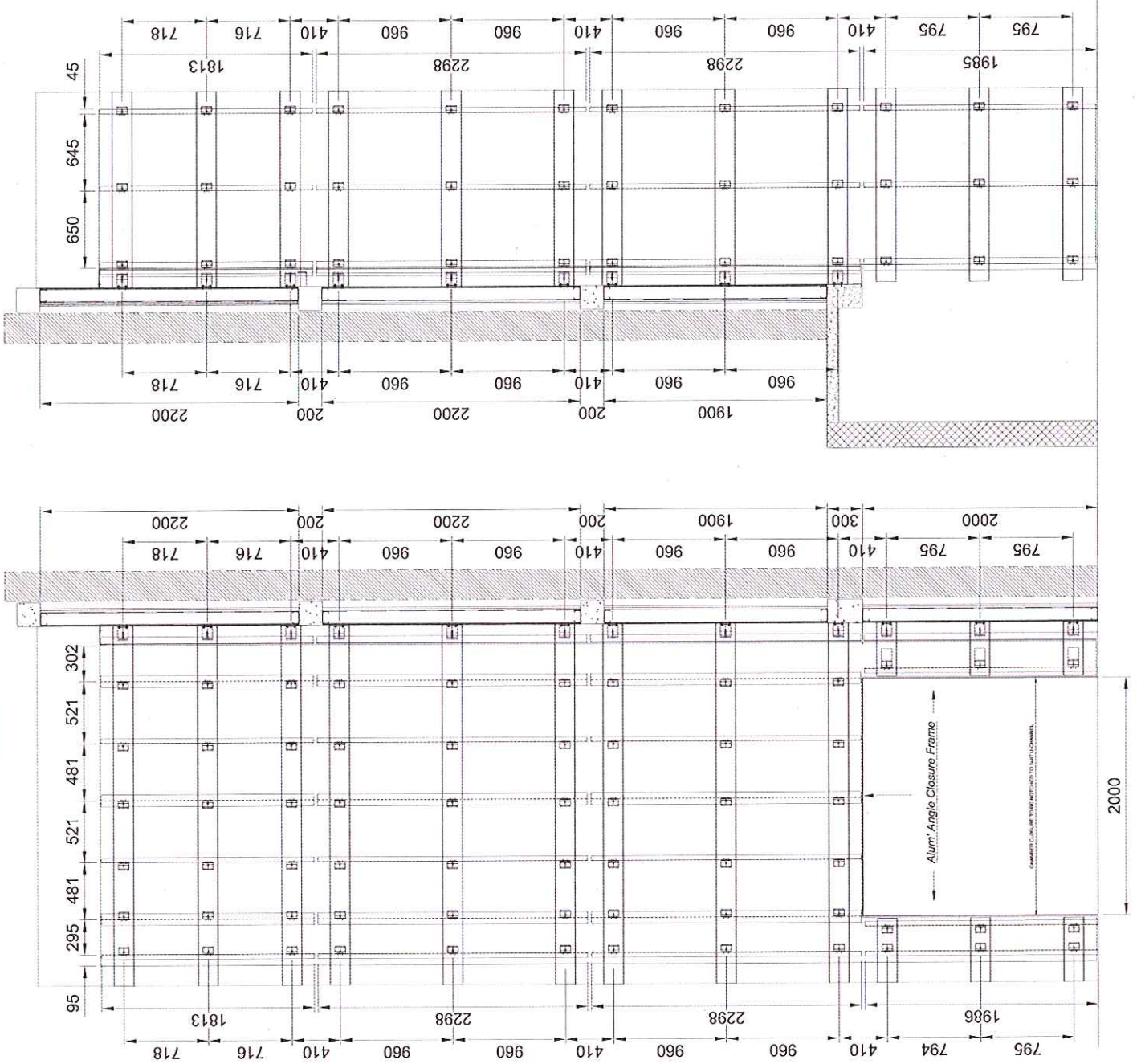
Drawn By: GI  
 Scale: 1: @ A3  
 Job No: Test 7 SFS  
 CAD Ref: Test 7 C.dwg

Checked By: Nick Jenkins  
 Date: Oct 2017  
 Dwg No: LTA  
 Rev'd:

AS BUILT



Elevation Layout Test 7 SFS  
 Scale 1:35@A3





**Important Notes**

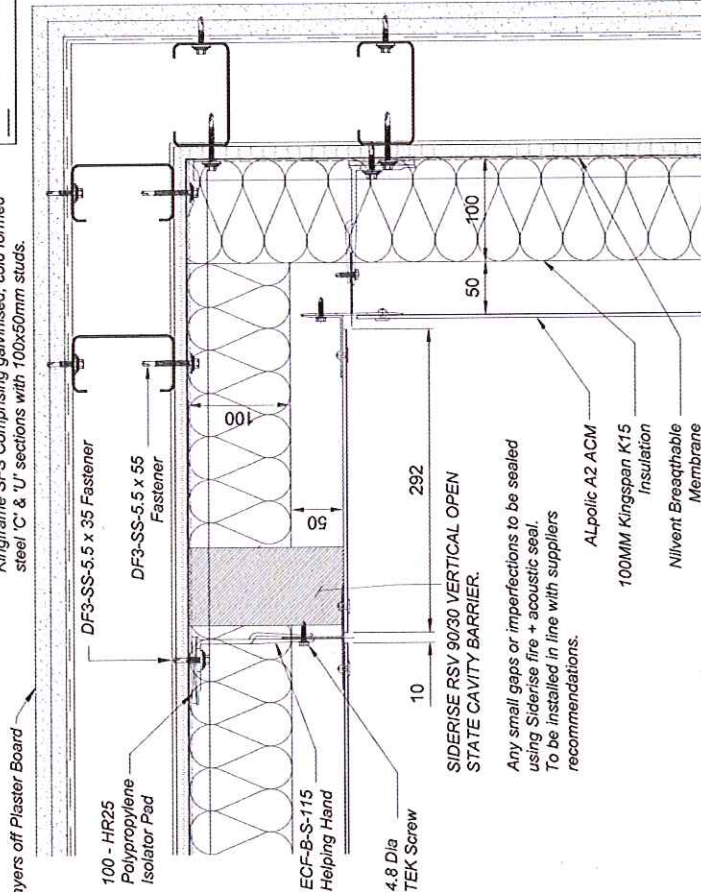
Panel: 4mm THK Alpolic ACM  
System: BML400  
Finish: - Anodized Look C31

All dimensions are theoretical and should be checked and verified prior to instruction to manufacture.

**REFERENCE DRAWINGS**

DT03 Horizontal Section Internal Corner Test SFS  
Scale 1:5@A3

Kingframe SFS Comprising galvanised, cold formed steel 'C' & 'U' sections with 100x50mm studs.



Rev	Date	Alteration	Initial
04	28.09.18	Updated as per Comments	GI
03	24.04.18	Updated as per Comments	GI
02	13.03.18	Detail Amended	GI
01	20.12.17	Final Issue	GI

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Client: KINGSFARM

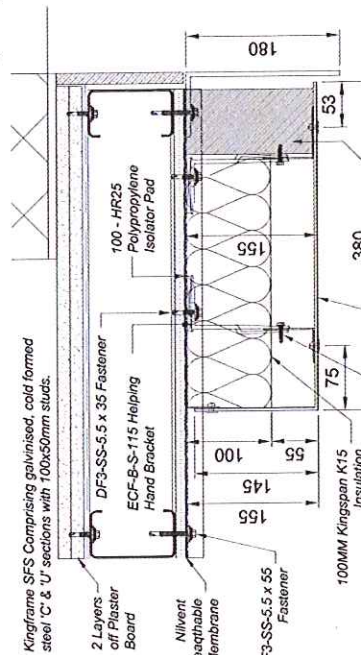
Project: Test 7 - BML400 - Alpolic A2 - 10mm part - K15

Title: Details 1

Drawn By: GI  
Scale: 1:5 @ A3  
Job No: SFS  
CAD Ref: Test 7 Cwg

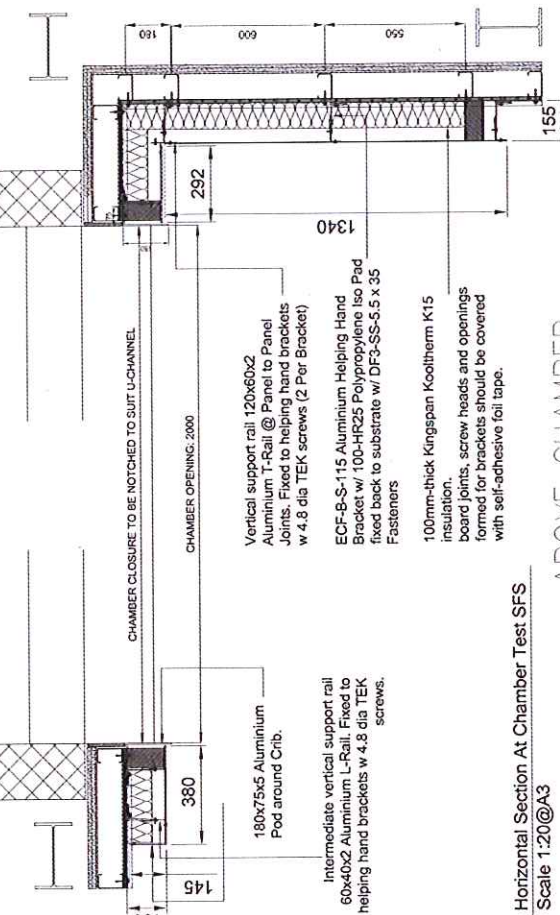
AS BUILT

**SIDERISE RSV 90/30 VERTICAL OPEN STATE CAVITY BARRIER**  
Any small gaps or imperfections to be sealed using Siderise fire + acoustic seal. To be installed in line with suppliers recommendations.



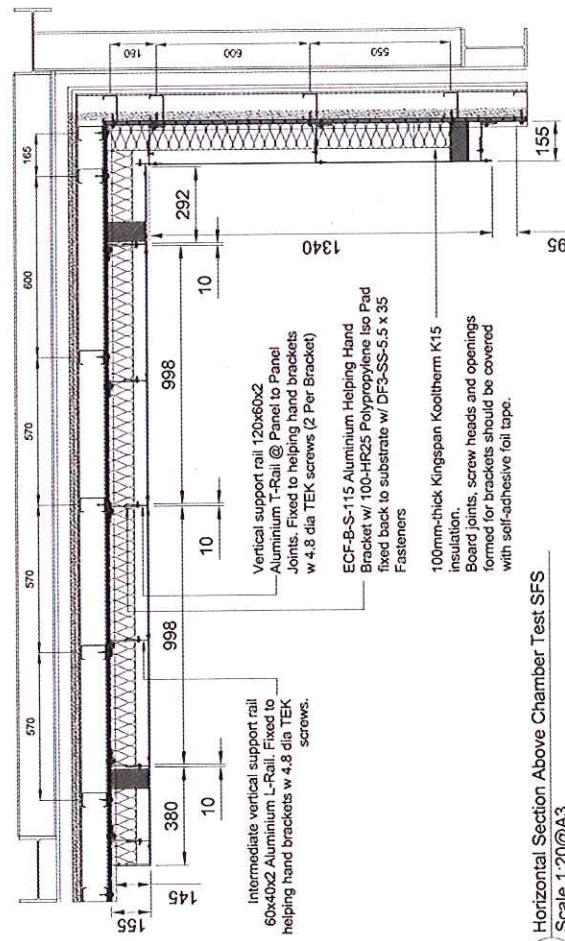
DT05 Enlarged Jamb Detail Test SFS  
Scale 1:6@A3

CHAMBER



DT01 Horizontal Section At Chamber Test SFS  
Scale 1:20@A3

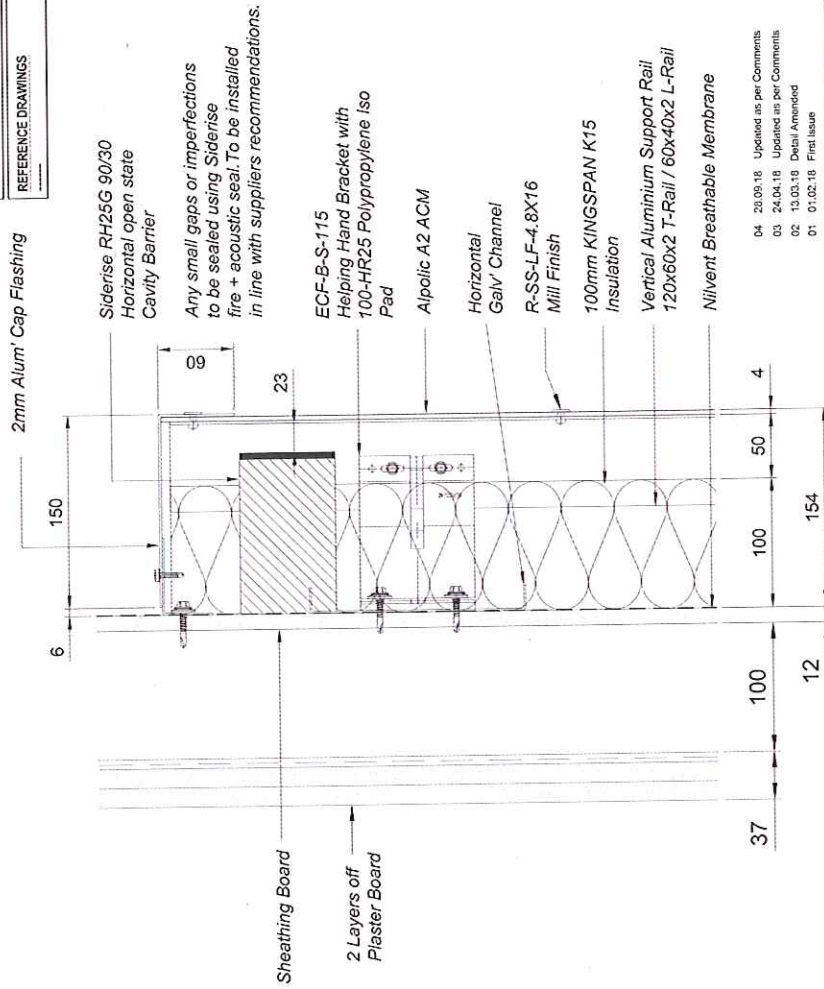
ABOVE CHAMBER



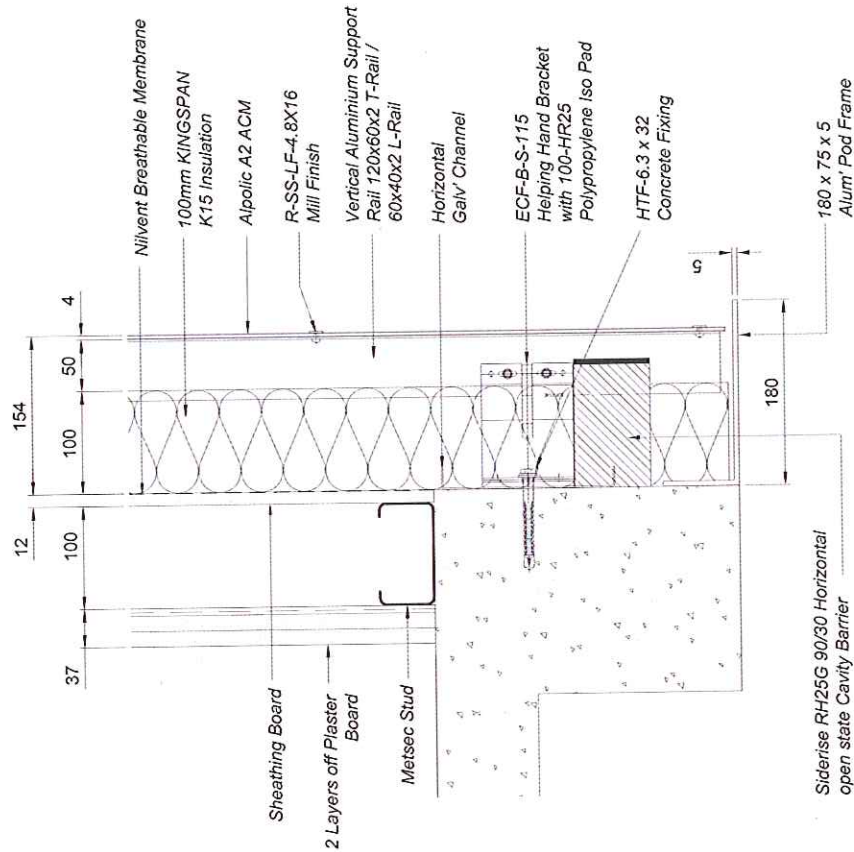
DT02 Horizontal Section Above Chamber Test SFS  
Scale 1:20@A3



DT06 Vertical Section At Head of Rig Test 7 SFS  
Scale 1:4@A3



DT05 Vertical Section At Head of Chamber Test 7 SFS  
Scale 1:5@A3



Siderise RH25G 90/30 Horizontal open state Cavity Barrier  
Any small gaps or imperfections to be sealed using Siderise fire + acoustic seal. To be installed in line with suppliers recommendations.

**Important Notes**  
Panels: 4mm THK Alpolic A2 ACM  
System: BML400  
Finish: Silver Met  
All dimensions are theoretical and should be checked and verified prior to instruction to manufacture.

**REFERENCE DRAWINGS**

GI 20.09.18 Updated as per Comments  
GI 24.04.18 Updated as per Comments  
GI 13.03.19 Detail Amended  
GI 01.02.19 First Issue

Initial  
Rev/ Date / Alteration

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**A EUROCLAD COMPANY**  
Client: KINGSPAN

Project: Test 7 - BML400 - Alpolic A2 - 10mm joint - K15  
Title: Details 5 & 6

Drawn By: GI  
Scale: 1: @ A3  
Job No: Test 7 SFS  
CAD Ref: Test 7 C.dwg

FOR APPROVAL



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**Table 5 Document Status**

Rev No.	Author	Reviewed & Approved for Issue		
		Name	Signature	Date
0	Arun Kumar M.	Manoj Kumar Lab. Manager		07/11/2018