

## Fire Performance Testing of an External Cladding System BS 8414-1:2015 + A1:2017

### Test Report

Prepared for : ROCKWOOL BV / Rockpanel  
Project : Classification of Rockpanel Durable 8mm  
Report No. : DLR1509 Rev.0  
Sample : Rockpanel Durable 8mm with ProtectPlus Finish and  
125mm ROCKWOOL Rainscreen Duo Slab Insulation



4559

September 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:

ROCKWOOL BV / Rockpanel,  
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NL-6040 KD Roermond, Netherlands.

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AFE Job/Sample Number: PD 106722/ C2858

The test sample consisted of an external wall cladding system (Rockpanel Woods, Durable 8mm with 125mm ROCKWOOL Rainscreen Duo Slab Insulation) installed on behalf of ROCKWOOL BV / Rockpanel.

This test report is personal to the client, confidential, non-assignable and shall not be reproduced, except in full, without prior written approval of AFE.

## 1.1 Purpose of Testing

The test was carried out on 5<sup>th</sup> June 2018 and was to determine the fire performance of the Rockpanel external wall cladding system fixed to the masonry face when exposed to external fire under controlled conditions. The test method was in accordance with AFE test method statement DMC2858/MSrev0, which was in accordance with the following standard:

- ▶ BS 8414-1: 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:

Pascal Kabo - ROCKWOOL BV / Rockpanel  
Martin Gillespie - ROCKWOOL Middle East

The test was supervised 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 8414-1:2015 + A1:2017 without any early termination of the test.

**Table 1 Observations**

Parameters	Temperature data/observations
$T_s$ , start temperature	29°C
$t_s$ , start time	73 seconds after ignition of the crib (thermocouple 3)
Peak temperature & time at Level 2 (External)	754°C at 996 seconds from $t_s$ (thermocouple 11)
Peak temperature / time at Level 2 (Internal cavity)	753°C at 1635 seconds from $t_s$ (thermocouple 22)
Peak temperature / time at Level 2 (Mid Depth of 125mm ROCKWOOL Rainscreen Duo Slab)	681°C at 1764 seconds from $t_s$ (thermocouple 30)

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 mainly comprised of:

- ❖ Rockpanel Durable 8mm with ProtectPlus Finish (B-S2,d0)
- ❖ 125mm ROCKWOOL rainscreen duo slab insulation
- ❖ ROCKWOOL SP Firestop VRB 60/60 horizontal open state cavity barrier.
- ❖ ROCKWOOL SP-60 vertical cavity barrier
- ❖ Fast frame FF Fix/BRD/160 helping hand bracket
- ❖ Aluminium T-rail and L-rail

Main wall - 3095mm wide x 9202mm high.

Wing wall - 1500mm wide x 9202mm high.

The top end of the cladding system was closed with 2mm thick aluminium flashing. The main wall side was closed with Rockpanel boards and the wing wall side was left open. Interface between the cladding system and the combustion chamber was covered with Rockpanel boards. The distance of the finished face of the wing wall to the side opening of the combustion chamber was approximately 220mm.

Photo DLP C2858/1162 shows an external view of the sample.

Figure 1 Photo DLP C2858/1162 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.

Material information described in Table 2 below is as supplied by ROCKWOOL BV / Rockpanel.

Table 2 System Details

Component	Description	Installation Details
Bracket	Fastframe FF Fix/BRD/160 helping hand bracket with plastic thermal shim. See photo DLP C2858/1071 in Appendix A.	The brackets were fixed to the masonry with EJOT T40-SW13 screws and nylon wall plugs. Plastic shims were placed between masonry wall and brackets.
Cavity barrier	<b>Horizontal intumescent cavity barrier:</b> ROCKWOOL SP Firestop VRB - 60/60 horizontal open state cavity barrier, 150x75mm. See photos DLP C2858/1107 & DLP C2858/1112 in Appendix A.	The horizontal cavity barriers were fixed to the masonry with brackets and Hilti DBZ 6/4 anchors.  3 nos. of horizontal continuous cavity barriers were fixed to the main wall and wing wall, at 155mm above the combustion chamber opening, 3210mm and 6250mm above the combustion chamber.
	<b>Vertical cavity barrier:</b> ROCKWOOL SP-60 vertical cavity barrier, 75x175mm. See photos DLP C2858/1107 & DLP C2858/1112 in Appendix A.	1 no. continuous vertical cavity barrier was fixed to the masonry on the main wall with brackets and Hilti DBZ 6/4 anchors.
Insulation	125mm ROCKWOOL rainscreen duo slab insulation. See photos DLP C2858/1112 & DLP C2858/1137 in Appendix A.	Insulation was fixed to the masonry wall with EJOT DMH 8x250 metal fixings and EJOT 140 polypropylene fixings.
Railing	100x60x2mm Aluminum vertical 'T' rail 60x40x2mm Aluminum vertical 'L' rail See photo DLP C2858/1137 in Appendix A.	Railings were fixed to the brackets and screwed with it by screws.
Cladding panel	Rockpanel Durable 8mm with ProtectPlus Finish (B-S2,d0) See photo DLP C2858/1154 in Appendix A.	Rockpanel boards were fixed to the railings with SFS rivets AP14-50180.  8mm joints were provided between the Rockpanel boards.

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



### Sample installation

AFE monitored the installation of the sample based on the drawings supplied by ROCKWOOL BV / Rockpanel, which are included in Appendix B of this report. Any deviation of the installation from these drawings were recorded and reported.

Date of installation: 28 May '18 to 03 June '18

Ambient temperature range: 27 - 38°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 8414-1:2015 + A1:2017 standard.

The rig comprised of two mutually perpendicular walls (constructed from the masonry bricks of compressive strength: 7.3 N/mm<sup>2</sup>, density: 730kg/m<sup>3</sup> and thermal conductivity: 0.18W/mK), one referred to as the main wall with a width of 3275mm and the other as the wing wall with a width of 2685mm. The total height of the test rig was 9180mm.

A combustion chamber with an opening of 1999mm x 2010mm was positioned at the base of the main vertical wall.

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 8414-1:2015 + 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 wall on the centre line and at 500mm & 1000mm each side of the centre line of the combustion chamber (five locations). Thermocouples were also positioned in front of the wing wall, at 150mm, 600mm & 1050mm from the finished face of the main wall (three locations).

#### 4.3.2 Internal thermocouple locations at Level 2

Thermocouples were positioned within each layer of the main test wall face greater than 10mm 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 within each layer of the wing test wall face greater than 10mm at 150 mm, 600 mm and 1050 mm from the finished face of the main test wall face (three locations).

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

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

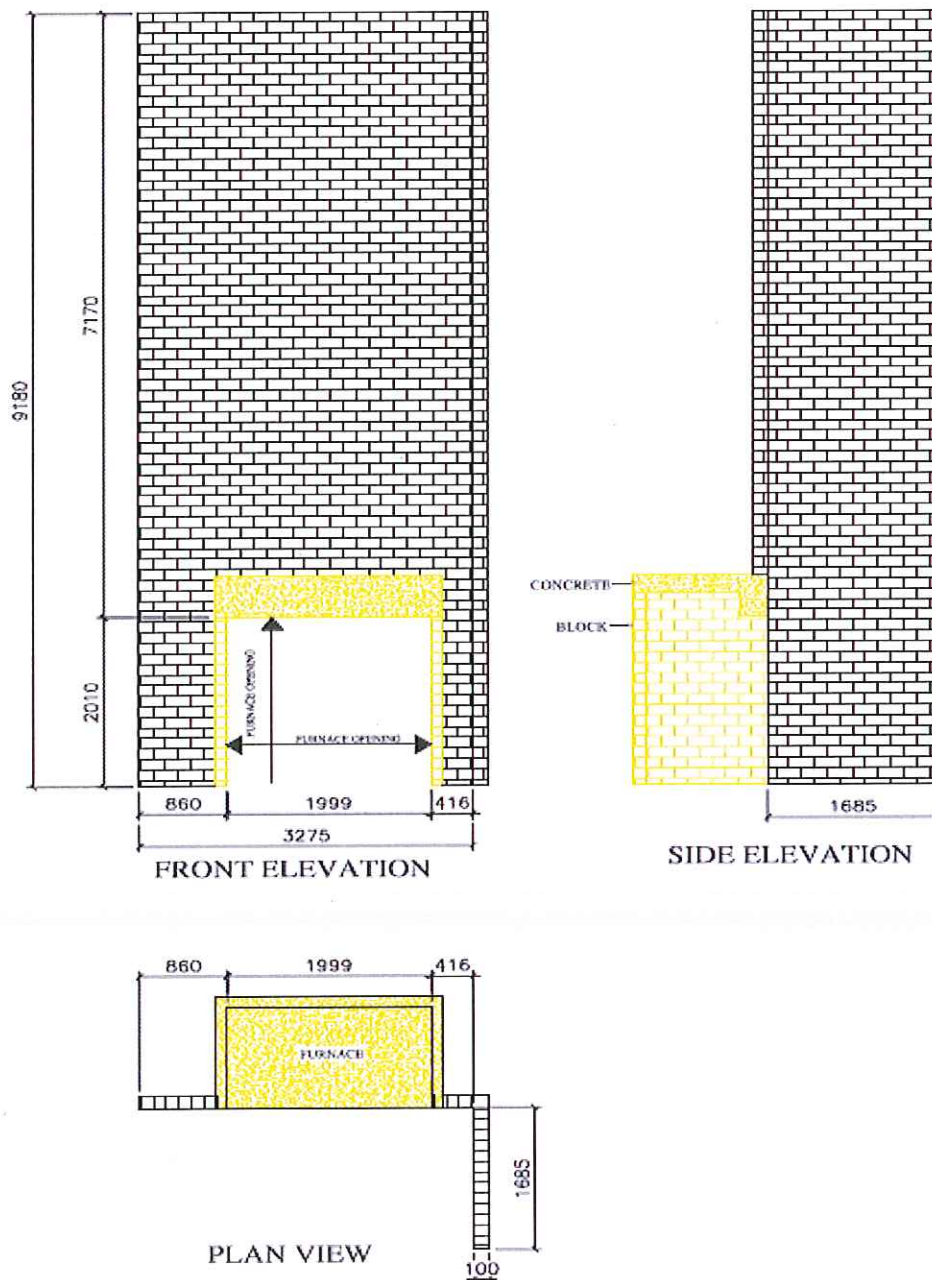


Figure 3 Thermocouple, Cavity Barrier Locations & Panel Numbering

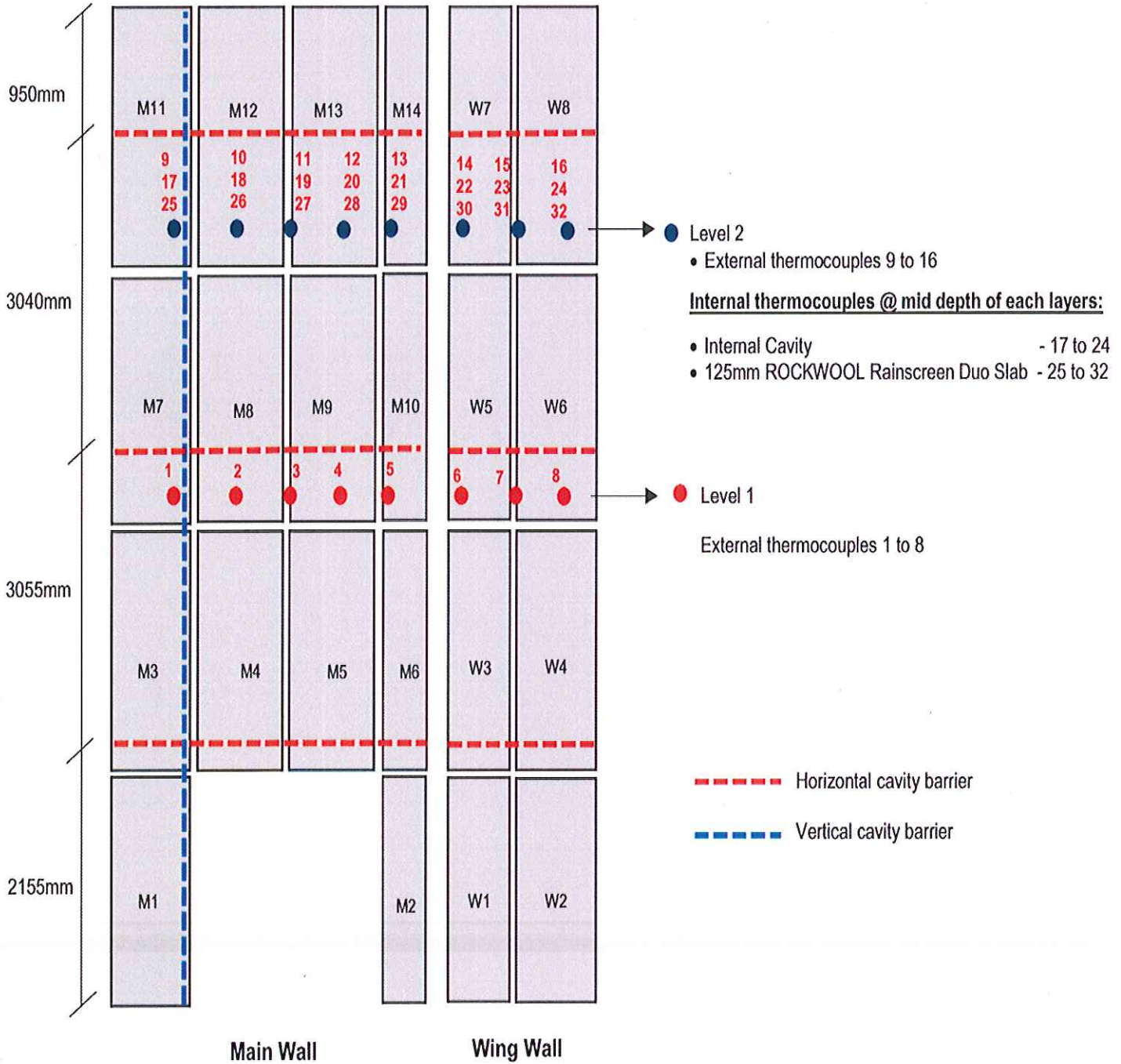
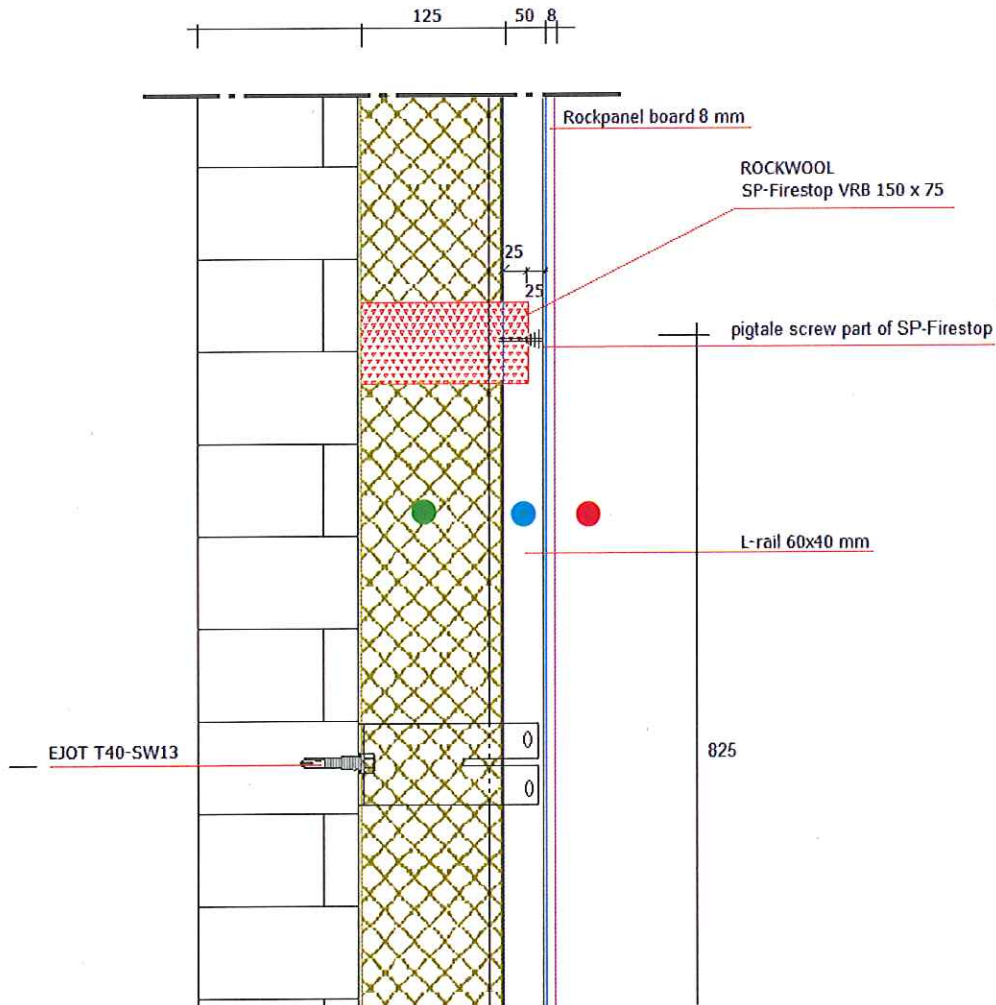


Figure 4 Level 2 Section Showing the Thermocouple Locations



- Level 2, External thermocouples 9 to 16
- Level 2, Internal thermocouples in cavity 17 to 24
- Level 2, Internal thermocouples in the insulation 25 to 32

## 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

Installation date: 28 May 18 to 03 June 18

Ambient temperature during installation: 27°C - 38°C

Date of testing: 05 June 18

Ambient temperature: 29°C

Wind speed: 0.12 m/s

Table below summarises the observations during the test.

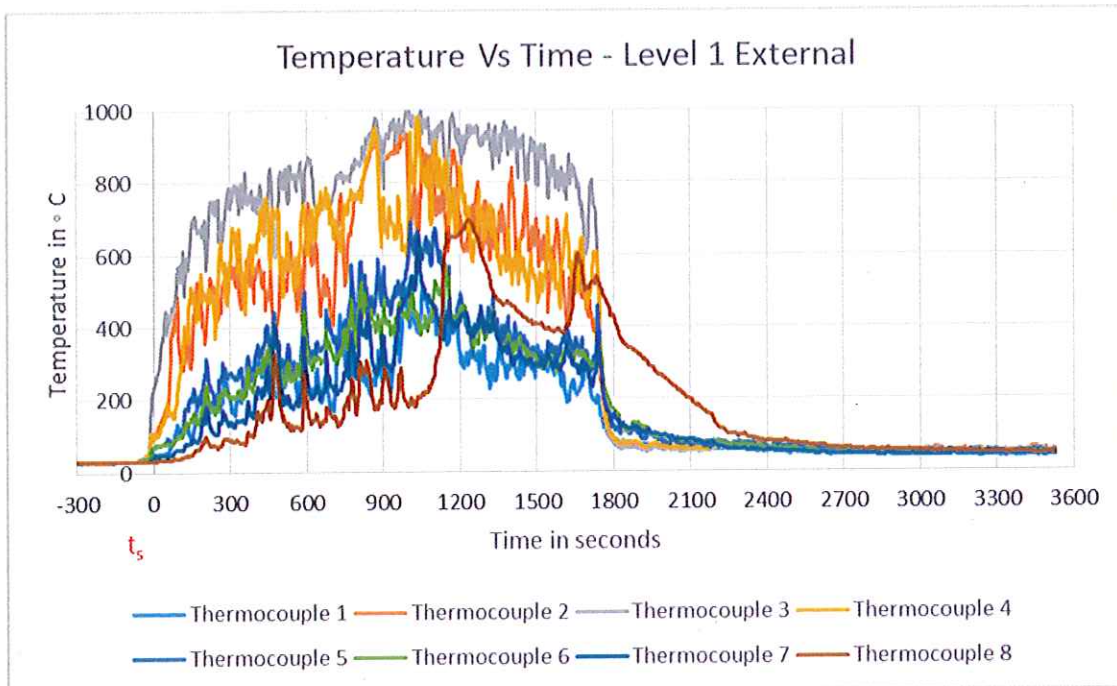
**Table 3 Visual Observations During the Test**

Time	Seconds	Observation	Photo Reference
06:10:00	-	Ignition of crib	-
06:10:53	-	Flame tip reached above the combustion chamber.	-
06:11:13	00	Start time $t_s$ , 236°C ( $\geq T_s + 200^\circ\text{C}$ ) at thermocouple 3, Level 1 (main wall).	-
06:12:52	99	Flame tip reached 2m above the combustion chamber.	-
06:13:47	154	External paint finish on panels M4 & M5 started peeling off.	-
06:15:14	241	External paint finish on panels M8 & M9 started peeling off.	-
06:19:07	474	Sustained flames on the face of panel W3.	-
06:19:18	485	Discoloration on panels W3 & W4.	DLP C2858/0001
06:20:10	537	Flame tip reached 4m above the combustion chamber.	-
06:22:14	661	Approximately 50% of panels M4, M5 & W3 discoloured.	DLP C2858/0002
06:24:38	805	Discoloration on panel W1.	
06:24:45	812	Panel M5 detached partially and flame on the insulation behind the panel.	DLP C2858/0003
06:25:32	859	Self-sustained flame at the panels W3 & W4 vertical joint.	-
06:25:55	882	Panel M5 fell off the main wall.	DLP C2858/0004
06:26:01	888	External paint finish on panels M12 started peeling off.	-
06:26:12	899	High intensity flame behind panel M4.	
06:26:41	928	Sustained flames behind panels W1 & W3.	DLP C2858/0005
06:27:49	996	Panel M4 detached and fell off the main wall.	DLP C2858/0006

Time	Seconds	Observation	Photo Reference
06:28:20	1027	Railings behind panels M4 and M5 melted.	-
06:28:59	1066	Panel W3 detached and fell off the wing wall.	DLP C2858/0007
06:29:33	1100	Panel M6 detached and fell off the main wall.	-
06:29:53	1120	Flame on the insulation and railings behind panel M8 & M9.	-
06:30:21	1148	Panel M9 detached and fell off the main wall.	DLP C2858/0008
06:31:01	1188	Self-sustained flame behind panel W5.	-
06:32:05	1252	Panel W1 detached from wing wall.	
06:32:16	1263	Discoloration on panels M13 & W6.	-
06:33:53	1360	Railings behind panel M9 melted.	-
06:34:31	1398	Panel M2 detached and fell off the main wall.	
06:34:55	1422	Panel M8 detached and fell off the main wall.	DLP C2858/0009
06:40:00	1727	The heat source was extinguished, observation was continued for another 30 minutes.	-
06:42:15	1862	All visible flames ceased.	-
06:47:38	2185	Debris of panels W4 and W5 fell off.	DLP C2858/0010
06:59:25	2892	No significant changes.	-
07:10:00	3527	Test was terminated 60min after the ignition.	-

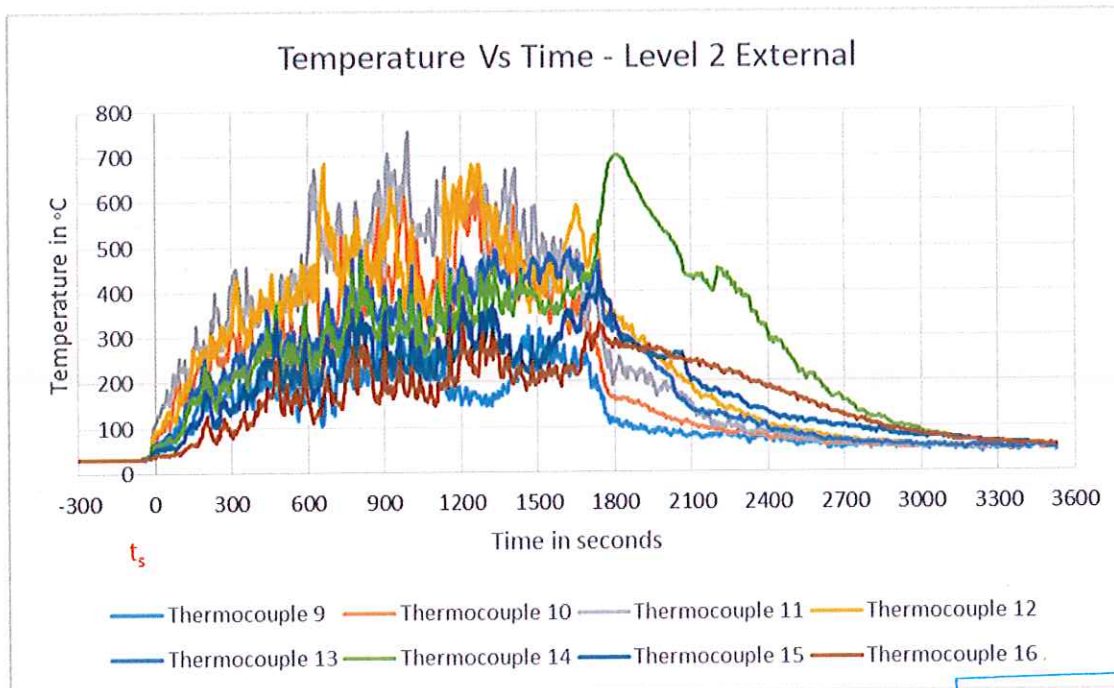


**Figure 5 Thermocouple Readings on Level 1 – External**



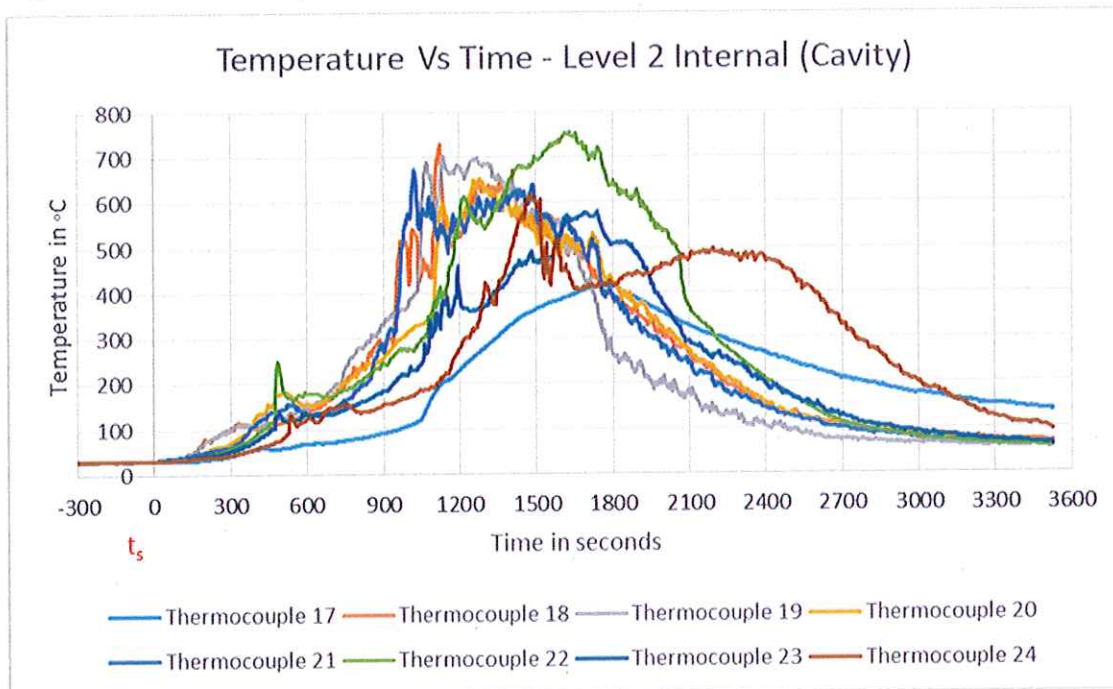
For thermocouple locations see Figure 3 & 4

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



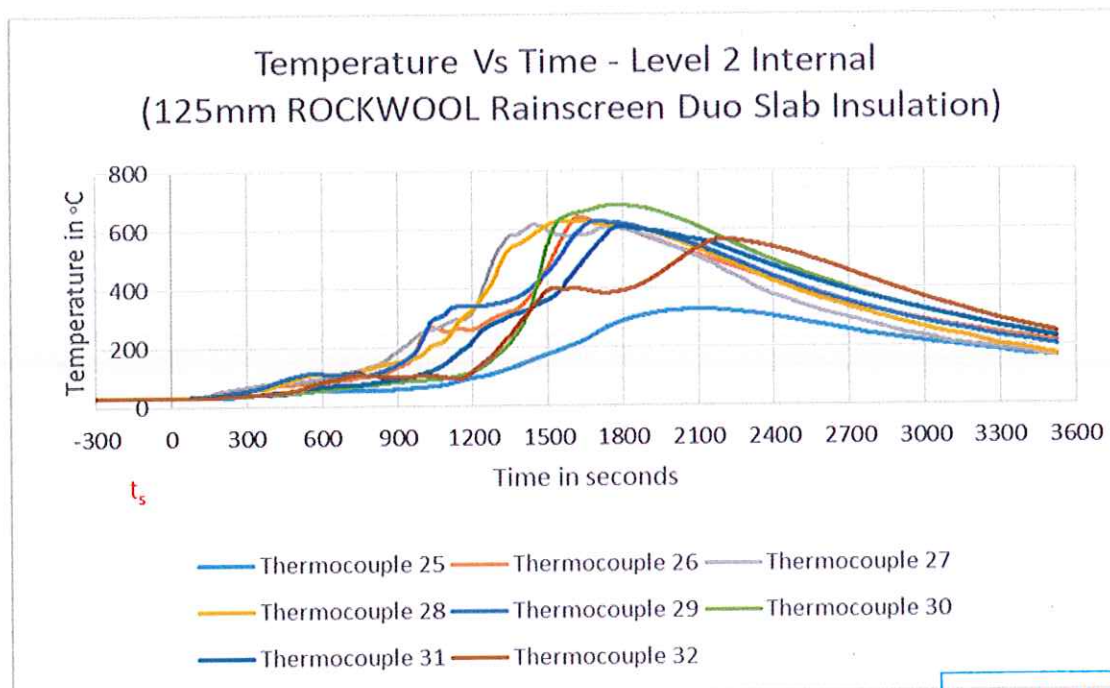
For thermocouple locations see Figure 3 & 4.

**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 125mm ROCKWOOL Rainscreen Duo Slab Insulation)**



For thermocouple locations see Figure 3 & 4.

## 6.1 Post-test Examination

Table 4 below summarises the post-test observations.

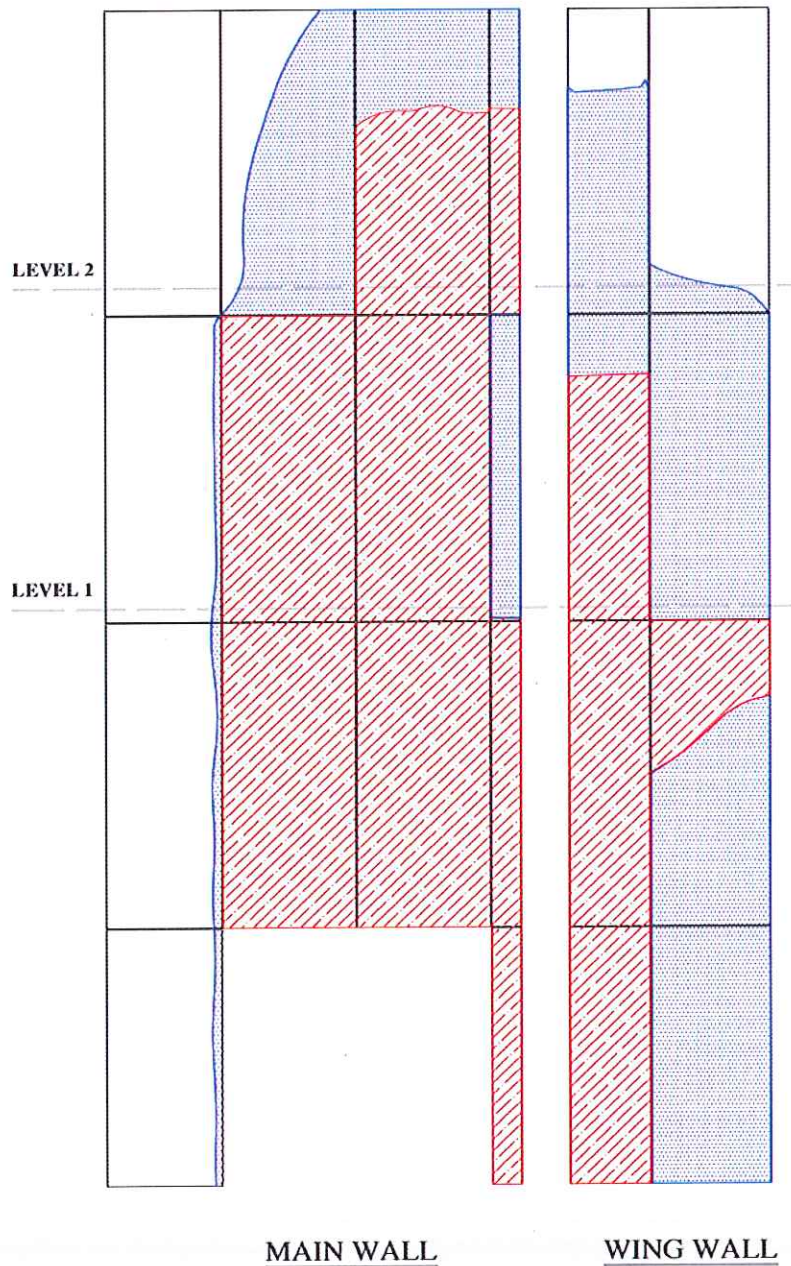
**Table 4 Post-test Observations**

Sl. No.	Components	Observation	Photo Reference
1	Rockpanel boards	<p>Panels M1, M3, M7 &amp; M11 – No material loss on the panels. Minor discoloration observed.</p> <p>Panels M2, M4, M5, M8 &amp; M9 – 100% material loss observed.</p> <p>Panels M6, M10, M13 &amp; M14 - Approximately 60% of the panel fell off during the testing. Remaining area was discoloured and buckled.</p> <p>Panel M12 – Approximately 50% of the panel was discoloured.</p> <p>Panels W1 &amp; W3 - 100% material loss observed.</p> <p>Panels W2 &amp; W6 – 100% of the panel was discoloured.</p> <p>Panel W4 - Approximately 20% of the panel fell off during the testing. Remaining area was discoloured.</p> <p>Panel W5 - Approximately 80% of the panel fell off during the testing. Remaining area was discoloured.</p> <p>Panel W7 - No material loss on the panels. Approximately 80% of the panel was discoloured.</p> <p>Panel W8 - No material loss on the panels. Approximately 10% of the panel was discoloured.</p>	<p>DLP C2858/0011</p> <p>See Figure 9 in this section for the damaged areas</p>
2	Cavity barrier	<p><b>Horizontal intumescent cavity barrier:</b></p> <p>Main wall:</p> <p>The 1<sup>st</sup> horizontal cavity barrier at 155mm above the combustion chamber was activated except the cavity behind panel M3. Intumescent layer was not present during the dismantling. Material loss and damage was observed.</p> <p>The 2<sup>nd</sup> horizontal cavity barrier at 3210mm above the combustion chamber was activated except the cavity behind panel M7. Intumescent layer was not present during the dismantling. Material loss and damage was observed.</p>	<p>DLP C2858/0012, DLP C2858/0013, DLP C2858/0014 &amp; DLP C2858/0015.</p>

Sl. No.	Components	Observation	Photo Reference
		<p>The 3<sup>rd</sup> horizontal cavity barrier at 6250mm above the combustion chamber was activated except the cavity behind M11. Intumescent layer was present during the dismantling. Minor material loss observed.</p> <p>Wing wall:</p> <p>The 1<sup>st</sup> horizontal cavity barrier at 2155mm above the ground level was activated. Intumescent layer was not present during the dismantling. Material loss and damage was observed.</p> <p>The 2<sup>nd</sup> horizontal cavity barrier at 5210mm above the ground level was activated. Intumescent layer was present partially during the dismantling. Material loss and damage was observed.</p> <p>The 3<sup>rd</sup> horizontal cavity barrier at 8250mm above the ground level was activated. Intumescent layer was present during the dismantling. No material loss observed.</p>	
		<p><b>Vertical cavity barrier:</b></p> <p>Minor discolouration and material loss on the vertical cavity barriers on the main wall was observed.</p>	
3	125mm ROCKWOOL Rainscreen Duo Slab Insulation	<p>Minor material loss of the insulations behind the panels M5.</p> <p>Insulation behind panels M2, M4, M6, M8, M9, M10, M12, M13 &amp; M14 was discoloured.</p> <p>All other insulation on the main wall was in place and no damage was observed.</p> <p>Minor material loss of the insulation behind panel W3. All other insulation on the wing wall was discoloured and no damage was observed.</p>	DLP C2858/0012, DLP C2858/0013, DLP C2858/0014 & DLP C2858/0015.

Sl. No.	Components	Observation	Photo Reference
4	Railing	<p>All railings behind panels M4 &amp; M5 were melted off.</p> <p>Railings behind panels M8 &amp; M9 were partially melted off.</p> <p>All other railings on the main wall were in place and no damage was observed.</p> <p>Approximately 10% of the railings on the wing wall were melted off. Remaining areas were discoloured and buckled.</p>	<p>DLP C2858/0012, DLP C2858/0013 &amp; DLP C2858/0015.</p>
5	Brackets	<p>All brackets behind panels M4 &amp; M5 were partially damaged.</p> <p>All other brackets were in place and no damage was observed.</p>	<p>DLP C2858/0015</p>

Figure 9 Area Map Showing the Condition of the Rockpanel boards after the Test



 100% MATERIAL LOSS

 DISCOLORATION

- Approximately 17m<sup>2</sup> of the total external visible area fell off.
- Approximately 10m<sup>2</sup> of the total external visible area was discoloured.
- Approximately 11m<sup>2</sup> of the total external visible area had no damage or discoloration

## Appendix A

# Photographs

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

### Pre-test Phase

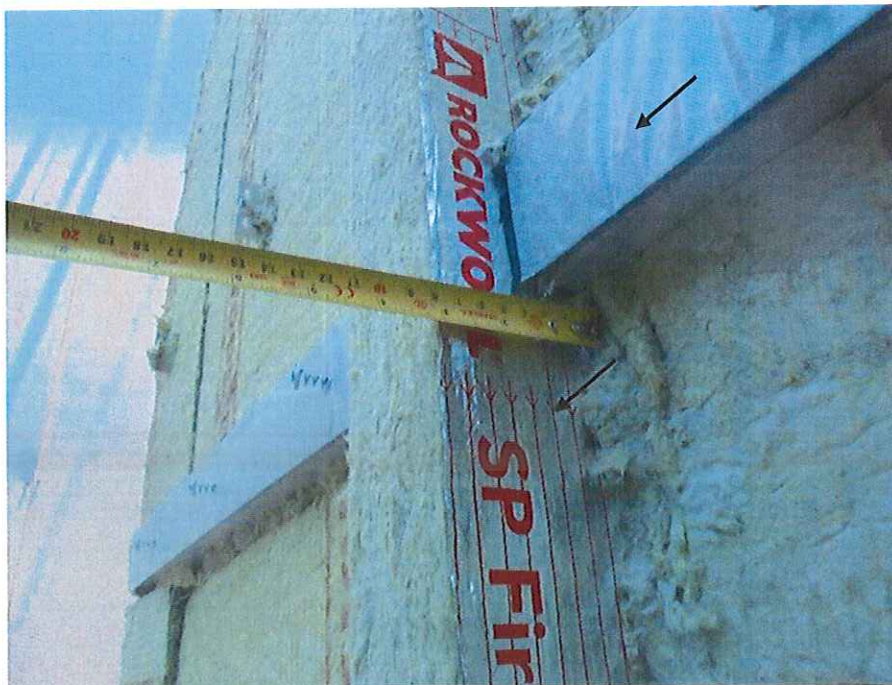


DLP C2858/1112 Cavity barriers and insulation



DLP C2858/1071

Helping Hand bracket



DLP C2858/1107

Horizontal intumescent and vertical cavity barrier





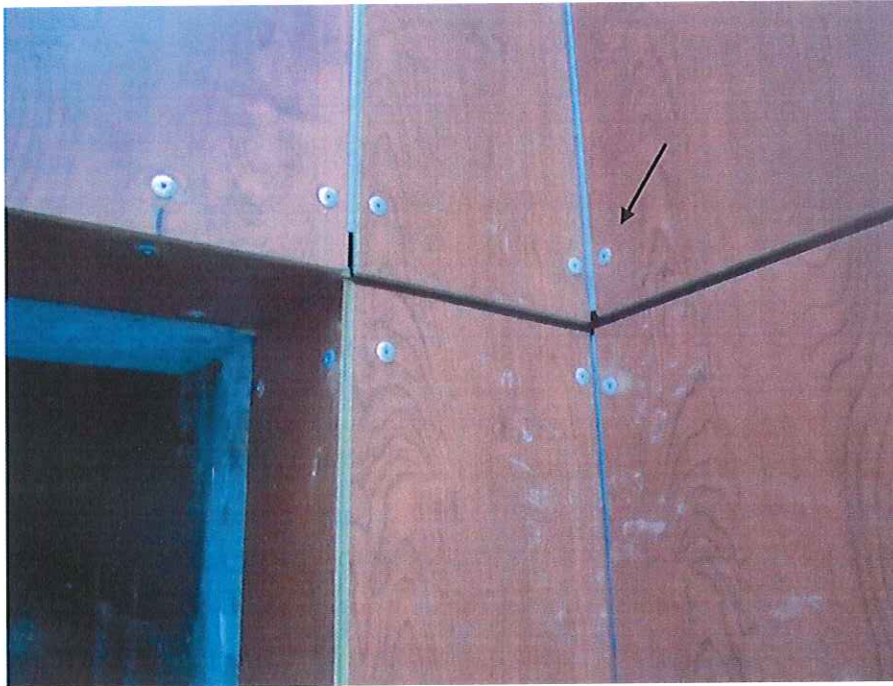
DLP C2858/1137

Insulation and railings



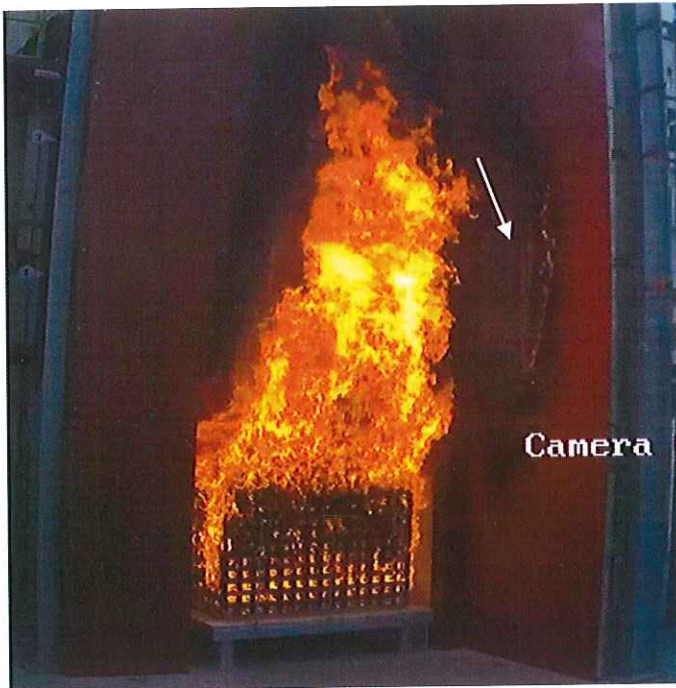
DLP C2858/1128

Fixing of railing to bracket

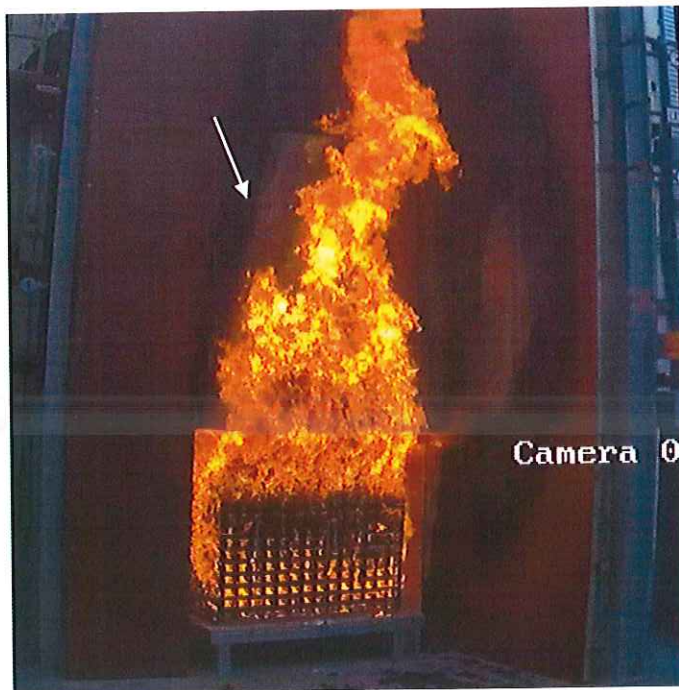


DLP C2858/1154 Rockpanel fixing

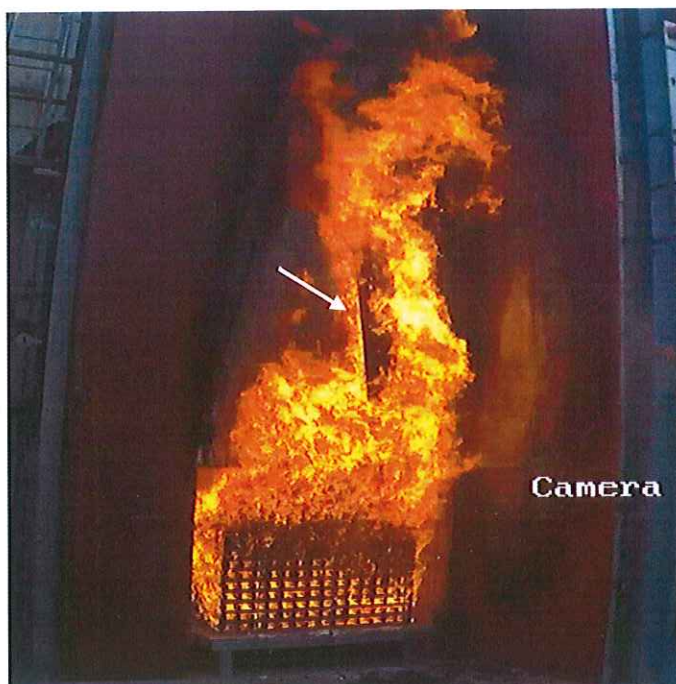
Testing Phase



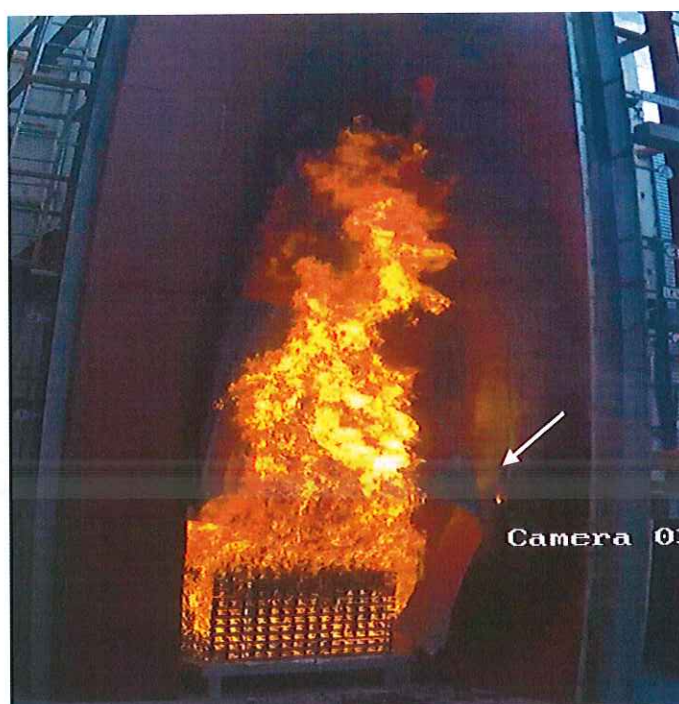
DLP C2858/0001 Discoloration on panels W3 & W4.



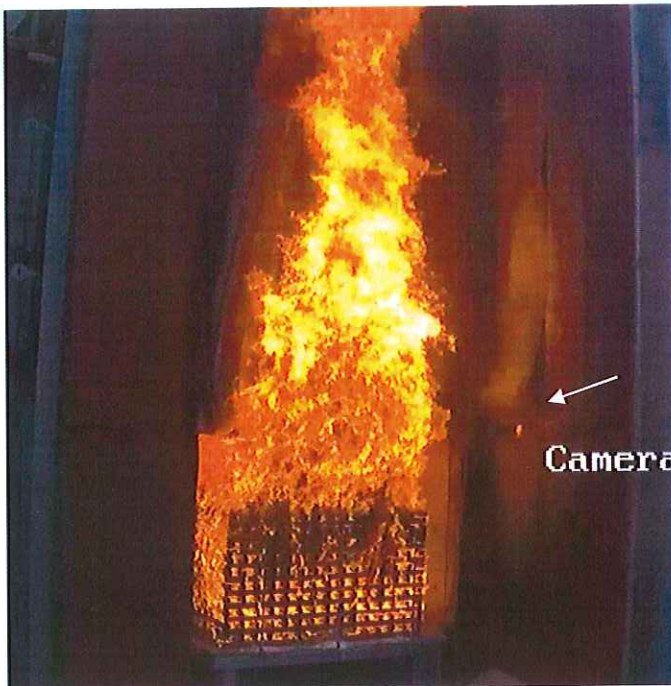
DLP C2858/0002 Approximately 50% of panels M4, M5 & W3 discoloured.



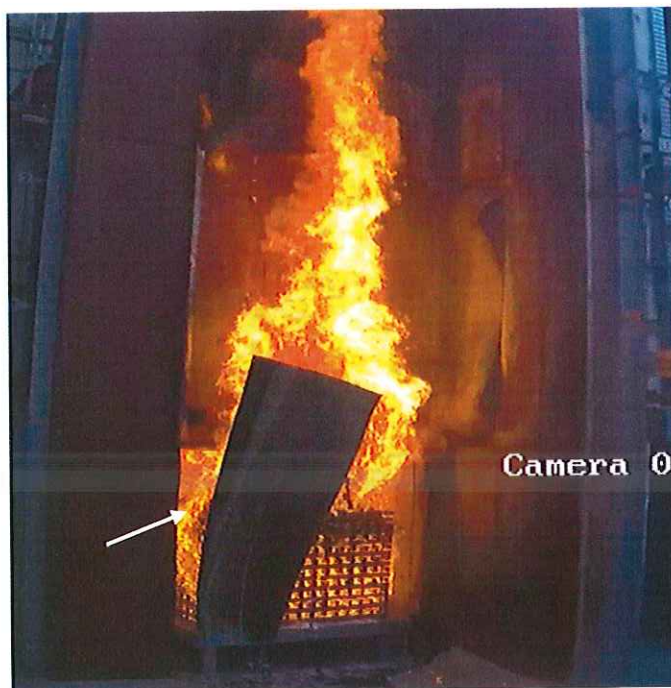
DLP C2858/0003 Panel M5 detached partially and flame on the insulation behind the panel.



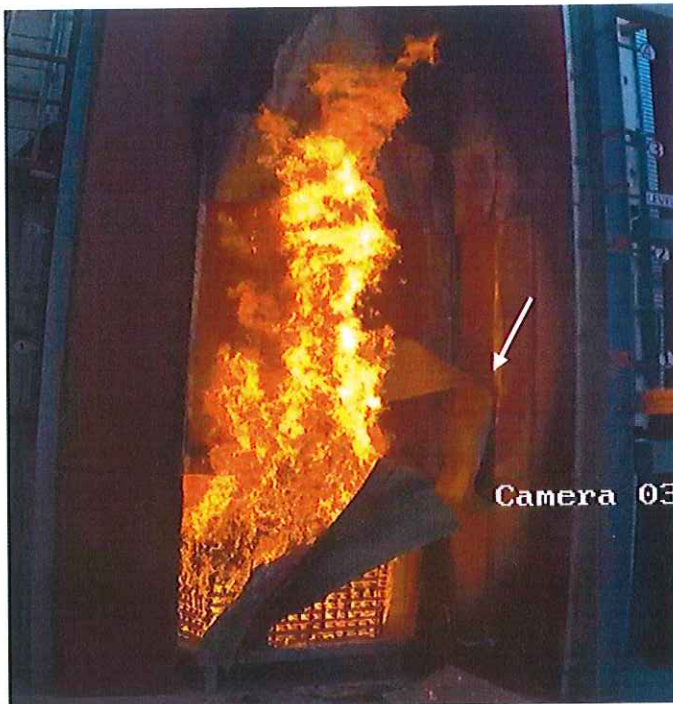
DLP C2858/0004 Panel M5 fell off the main wall.



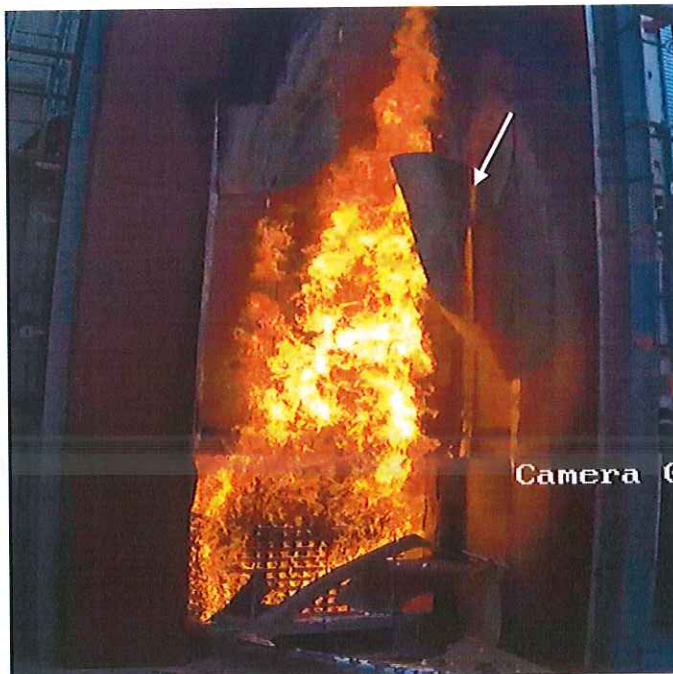
DLP C2858/0005 Sustained flames behind panels W1 & W3.



DLP C2858/0006 Panel M4 detached and fell off the main wall.



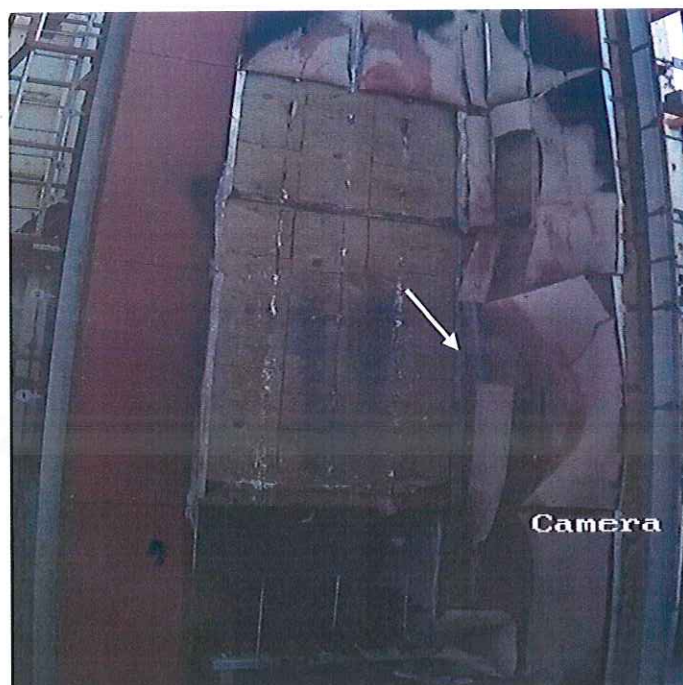
DLP C2858/0007 Panel W3 detached and fell off the wing wall



DLP C2858/0008 Panel M9 detached and fell off the main wall.



DLP C2858/0009 Panel M8 detached and fell off the main wall.



DLP C2858/0010 Debris of panels W4 (top part) & W5 fell off.

## Post-Test Phase



DLP C2858/0011

View of the sample after the test





DLP C2858/0012

Cavity barriers, insulation and railings



DLP C2858/0013

Vertical cavity barrier, insulation and railings



DLP C2858/0014

Cavity barrier at the top of combustion chamber



DLP C2858/0015

Cavity barrier on wing wall



DLP C2858/0016

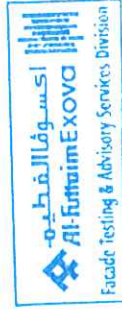
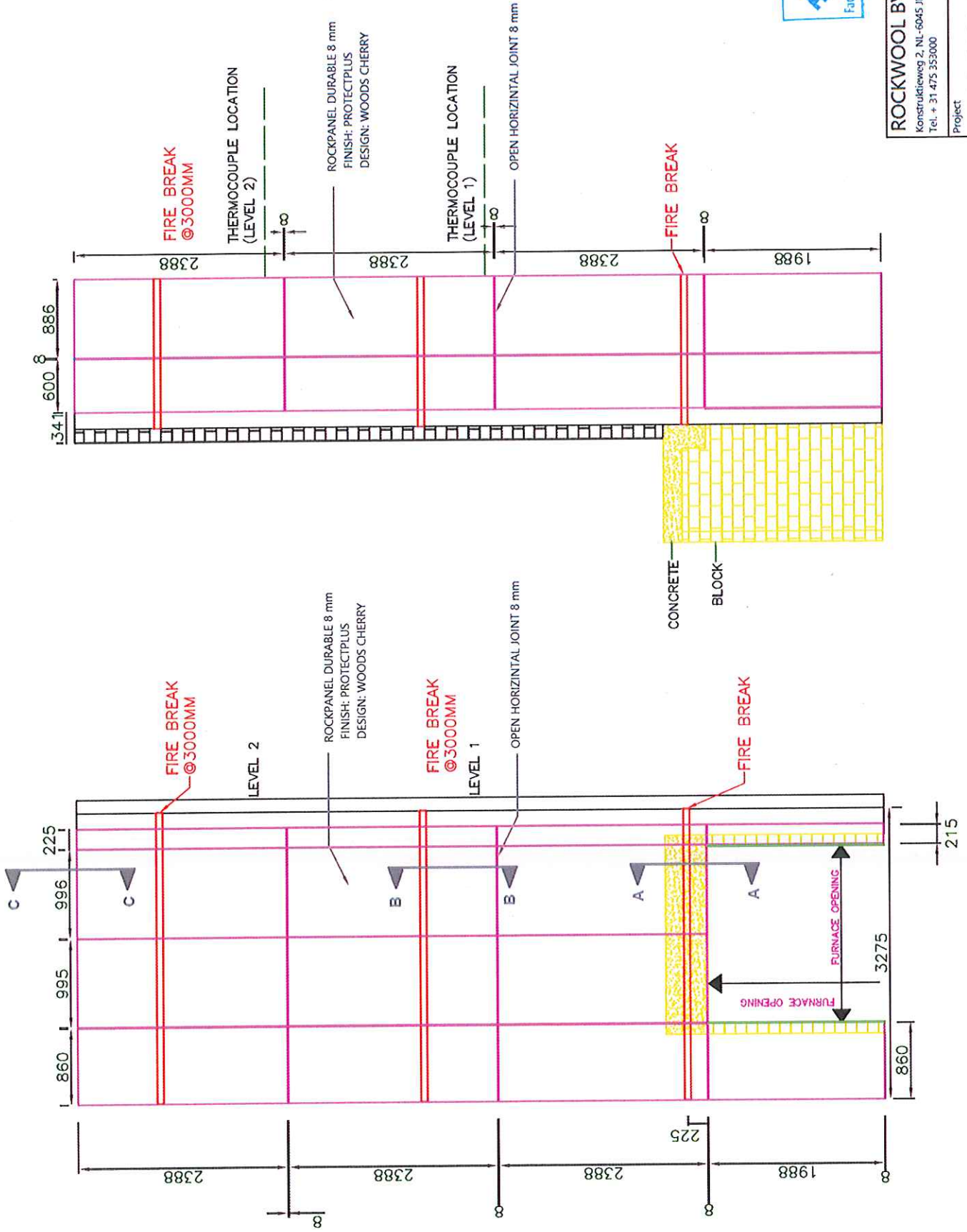
Brackets

## Appendix B

# Drawings

The following six un-paginated sheets are copies of ROCKWOOL BV / Rockpanel drawings numbered:

- DWG 01 - FRONT VIEW / PANEL LAYOUT
- DWG 02 - HORIZONTAL CROSS SECTION LEVEL '0'
- DWG 03 - DETAIL 01 / WINDOW JAMB & INTERNAL CORNER
- DWG 04 - CROSS SECTION AA / WINDOW HEAD
- DWG 05 - CROSS SECTION AA / SECTION FIRE BARRIER
- DWG 06 - CROSS SECTION CC / SECTION TOP FLASHING



ROCKWOOL BV/ Rockpanel

Konstruktieweg 2, NL-6045 JD Roermond, Netherlands  
Tel. + 31 475 353000

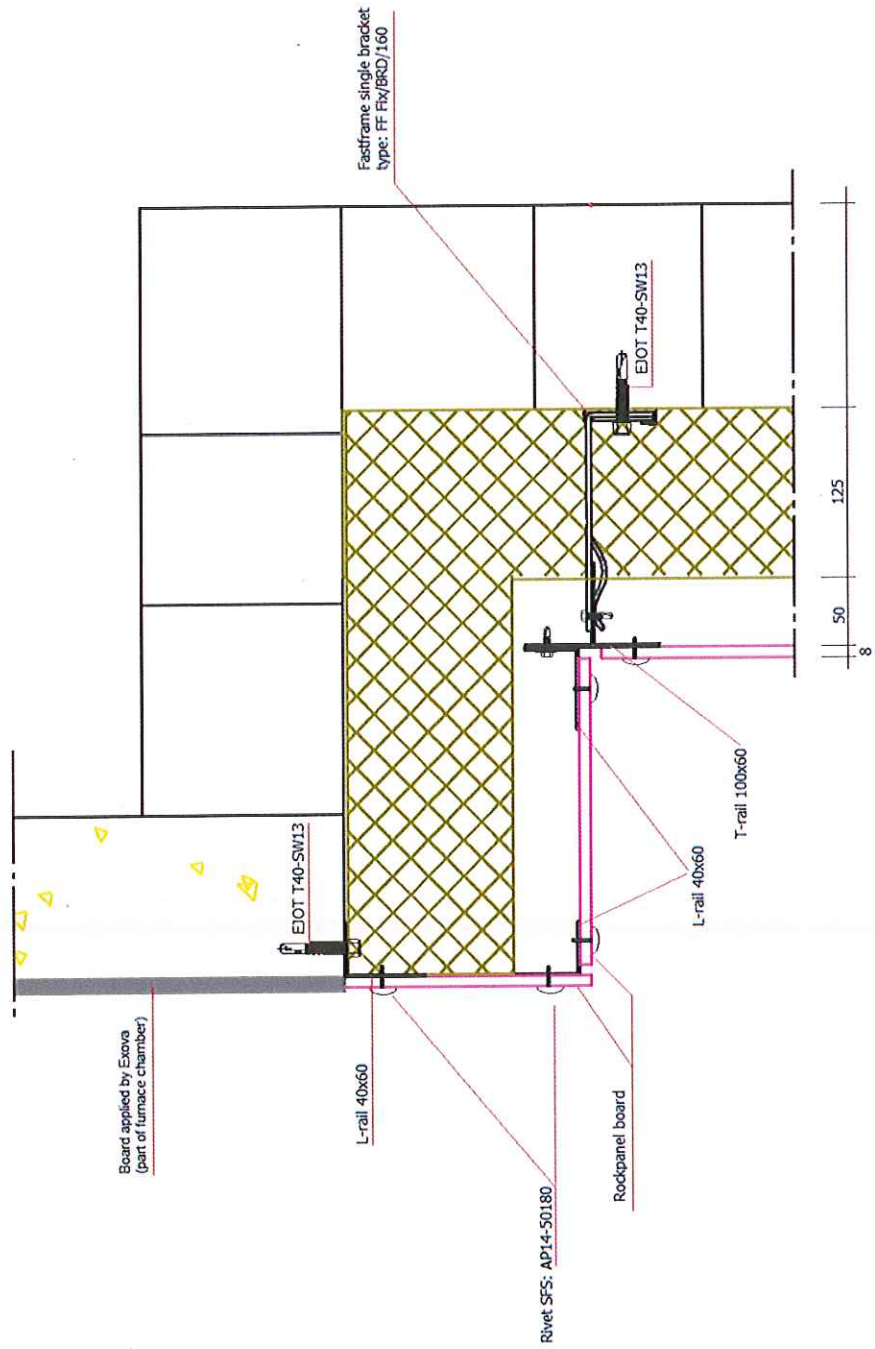
Project

FIRE TEST BS 8414-1

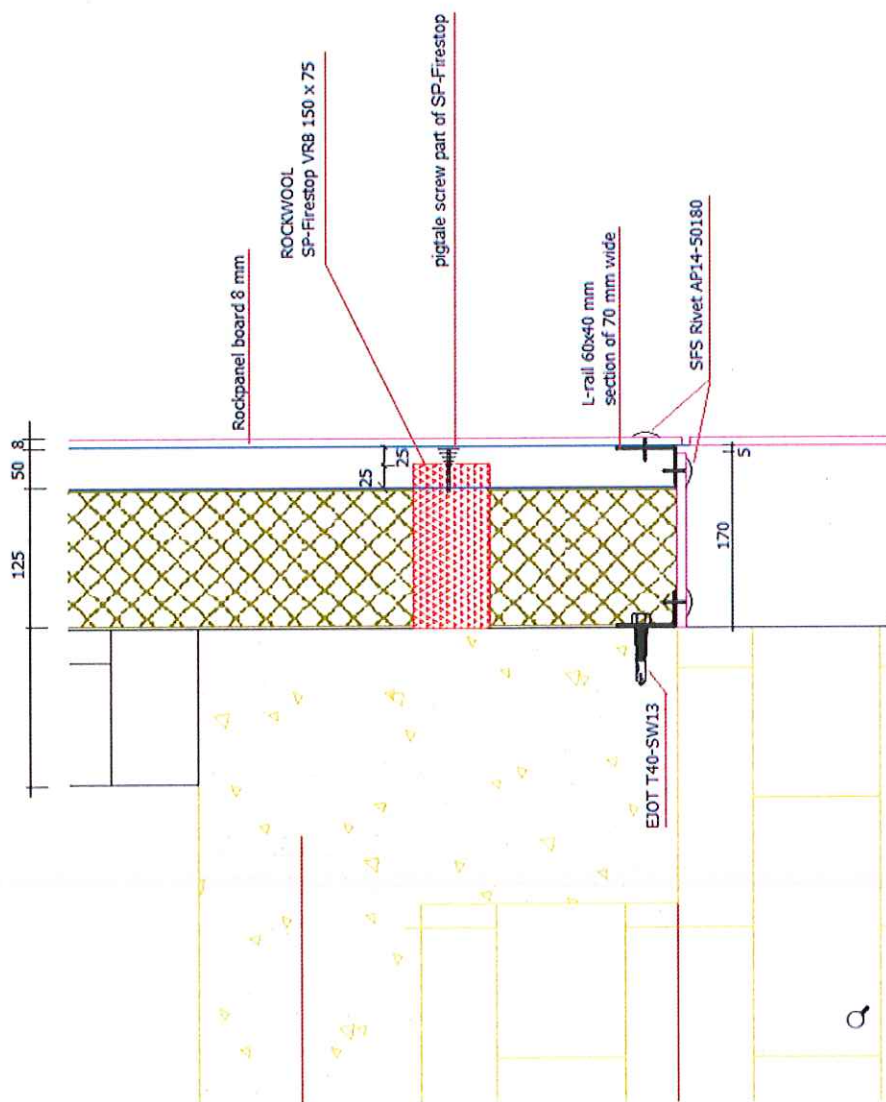
Title drawing

FRONT VIEW / PANEL LAYOUT





<b>ROCKWOOL BV/ Rockpanel</b>
Konstruktieweg 2, NL-6045 JD Roermond, Netherlands Tel. + 31 475 353000
Project <b>FIRE TEST BS 8414-1</b>
Title drawing <b>DETAIL 01 /</b> <b>WINDOW JAMB &amp; INTERNAL CORNER</b>



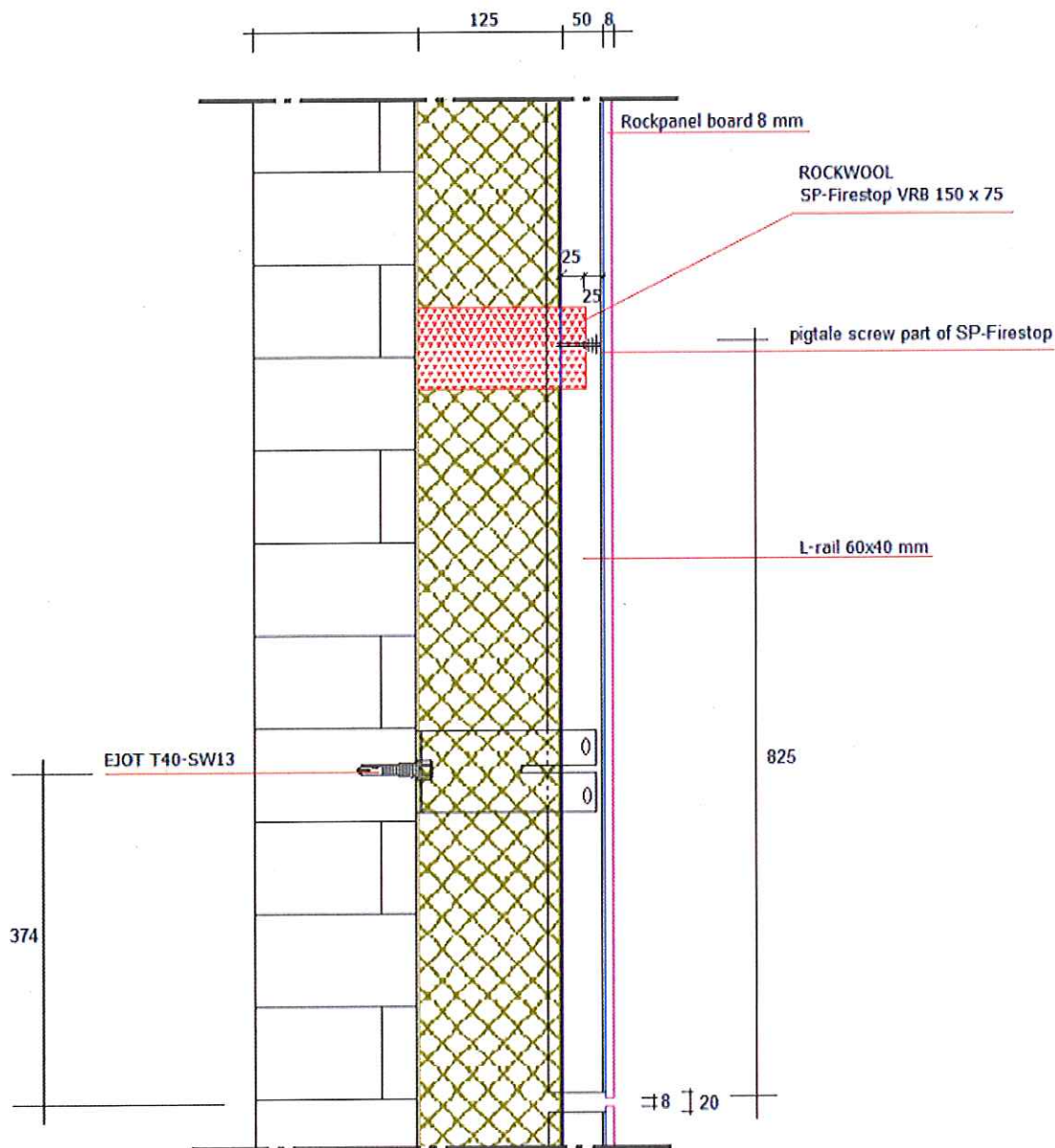
**ROCKWOOL BV / ROCKPANEL**

Konstruktieweg 2, NL-6045 JD Roermond, Netherlands  
Tel. +31 475 355000

Project  
**FIRE TEST BS 8414-1**

Title drawing  
**CROSS SECTION AA / WINDOW HEAD**





**ROCKWOOL BV/ Rockpanel**

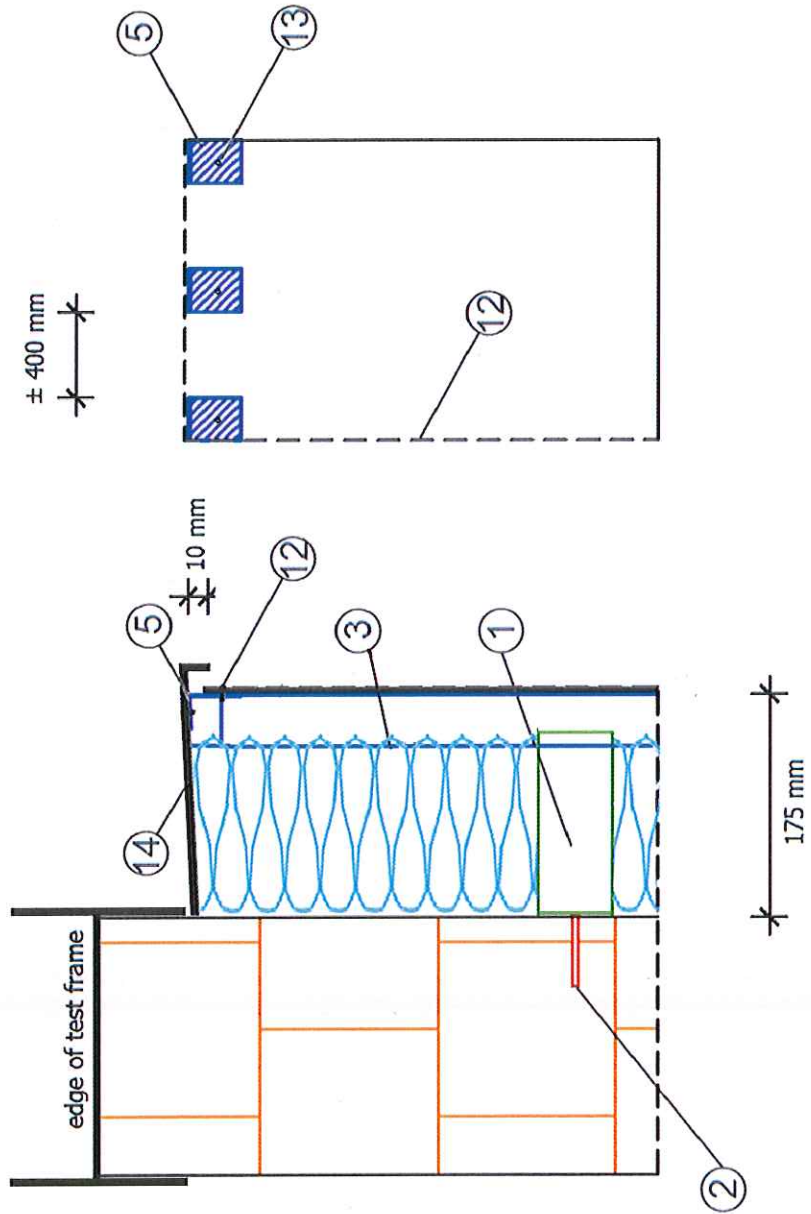
Konstruktieweg 2, NL-6045 JD Roermond, Netherlands  
Tel. +31 475 353000

Project

**FIRE TEST BS 8414-1**

Title drawing

**CROSS SECTION AA / SECTION FIRE BARRIER**



- 1: Single bracket Fastframe type: FF Fix/BRD/160
- 2: EJOI Façade screw T40/SW13 to fix bracket
- 3: ROCKWOOL rainscreen DUO slab 125 mm
- 5: Aluminium L-section 70 mm wide
- 12: 8 mm Rockpanel Durable with ProtectPlus finish (design: Woods cherry)
- 13: SFS : AP 14-50180 5 x18 rivet
- 14: Flashing

**ROCKWOOL BV/ Rockpanel**  
 Konstruktieweg 2, NL-6045 JD Roermond, Netherlands  
 Tel. + 31 475 353000

Project  
**FIRE TEST BS 8414-1**

Title drawing  
**CROSS SECTION CC / SECTION TOP FLASHING**



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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		15/11/2018