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BRE Global Test Report

BS8414-2: 2005 Test on a Kingspan K15 insulated system with a ventilated Terracotta tile rainscreen

Prepared for:	**Kingspan Insulation Ltd**
Date:	**3rd July 2018**
Report Number:	**303930 Issue: 3**

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1 Introduction

BS8414-2:2005 describes a method of assessing the behaviour of non-load bearing external cladding systems, rainscreen over-cladding systems and external wall insulation systems when applied to a structural steel frame 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.

The specification and interpretation of fire test methods is the subject of on-going development and refinement. Changes in associated legislation may also occur. For these reasons, it is recommended that the relevance of test reports over 5 years be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a legal review of the procedures adopted for a particular test to ensure they are consistent with current practices, and if required may endorse the test report.

All measurements given in this report are nominal unless stated otherwise.

This report is issue 3 of BRE Global report 303930. At the request of the client, a correction to the product description has been made in this report. BRE Global report 303930 dated 17th September 2015 has been withdrawn with effect from the date of this report.

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2 Details of tests carried out

Name of Laboratory:	BRE Global Ltd.
Laboratory Address:	Bucknalls Lane, Garston, Watford, Hertfordshire. WD25 9XX
Telephone No.:	01923 664000
Fax No.:	01923 664910
Test reference:	303930
Date of test:	21st April 2015
Sponsor:	Kingspan Insulation Ltd.
Sponsor address:	Pembridge Leominster Herefordshire HR6 9LA
Method:	The test was carried out in accordance with BS8414-2:2005
Deviations:	None

3 Description of the System

3.1 Description of substrate

The test specimen was installed onto wall 1 of the BRE Global External Cladding Test Facility. This is a multi-faced test facility constructed from steel, the outside to which the cladding system was affixed.

3.2 Description of product

The system prior to testing is shown in Figure 1. Full details of the system specification and installation details have been provided by the client and are summarised in the following section. The system, as built, comprised of:

- Double layer of 12.5mm Gyproc plasterboard
- 150mm steel frame
- 12mm cement particle board (Versapanel manufactured by Euroform products)
- Aluminium top hat supports
- Aluminium helping hand brackets
- AIM VRB plus firebreaks (2 x FF102 6.0 x 75 x 1000mm) horizontal intumescent expanding fire break fixed to a stone wool batt forming a 1000mm x 150mm x 195mm firebreak
- 2400mm x 1200mm x 140mm Kingspan K15 Insulation Board
- 580mm x 250mm x 30mm ArGeTon Tampa terracotta tiles

3.3 Installation of cladding System.

All test materials were supplied and installed by the sponsor. BRE Global 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.

3.3.1 Steel substructure and fixings

A sectional steel frame system (SFS) was installed between the floor slab hangers on the main cladding wall 1, with horizontal base and head tracks fixed to the steel substrate. Vertical rails were installed at nominal 600mm centres to the steel frame. A double layer of 12.5mm plasterboard was installed on the rear of the SFS and a single layer of cement particle board was fixed to the front of the SFS. The build-up of the cladding system is shown in Figures 2 to 6, drawings supplied by the sponsor.

3.3.2 Cladding system

An array of aluminium helping hand brackets were fixed to the aluminium top hats using self-drilling fixfast DF3-SS5.5x35 Grade A2 (see Figure 3). A single layer of 140mm Kingspan K15 insulation board was mechanically attached to the sheathing board with metal (197mm long) and plastic (160mm long) EJOT insulation screws. The insulation board was pushed over the helping hand brackets through pre-cut slots in the insulation boards.

3.3.3 Fire breaks

Three horizontal AIM VRB plus firebreaks (2 x FF102 6.0 x 75 x 1000mm horizontal intumescent expanding fire break fixed to a stone wool batt) were fixed back to the sheathing board in a continuous strip and any gaps between the fire break and the insulation board was sealed with “UF” jointing tape.

Stone wool fire barriers (75mm thick) were installed between the sheathing board and terracotta tiles on both sides and across the top of the hearth.

3.3.4 Rainscreen

An array of back to back stainless-steel angles (T) bolted together (vertical carrier rails) were fixed to the helping hand brackets with both L and T aluminium brackets used. A single layer of 30mm ArGeTon Tampa terracotta tiling was attached to the carrier rails using ArGeTon Tampa clips and the helping hand brackets.

3.4 Conditioning of the Specimen

Once the system was completed there was no requirement for conditioning before testing was undertaken.

3.5 Test Conditions

Ambient Temperature: 15.6°C

Wind speed: < 0.1 m/s, test undertaken indoors

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

Thermocouple locations:

Level 1 – External

Level 2 – External

Level 2 – Mid point of cavity 1

Level 2 – Mid point of insulation

Level 2 – Mid point of cement particle board

Level 2 – Mid point of cavity 2

Level 2 – Mid point of plasterboard

Figure 7 shows a schematic of the locations of the thermocouples for the test specimen.

4 Test results

4.1 Temperature Profiles

Figures 8 to 14 provide the temperature profiles recorded during the test. Figure 1 shows the sample before the test.

Table 1. Temperature profiles obtained from the data

Parameter	Result
T_s, Start Temperature	15.6°C
t_s, Start time	2 mins : 10 secs after ignition of the crib
Peak temperature/time at Level 2, 50mm external	600.5°C at 24 mins : 45 secs after t_s
Peak temperature/time at Level 2, Cavity 1	246.8°C at 25 mins : 55 secs after t_s
Peak temperature/time at Level 2, Insulation Layer	27.2°C at 11 mins : 35 secs after t_s
Peak temperature/time at Level 2, cement particle board	27.2°C at 60 mins : 15 secs after t_s
Peak temperature/time at Level 2, cavity 2	26.3°C at 59 mins : 0 secs after t_s
Peak temperature/time at Level 2, Plasterboard	21.2°C at 60 mins : 0 secs after t_s

4.2 Visual Observations

Table 2. Visual Observations made during the test

Time (mins:secs)	Description
-5:00	Logger start
0:00	Ignition of crib
2:30	Flames out of hearth
3:55	Flames to 1.5 m cladding wall main face.
5:20	Flames to 2m cladding wall main face.
6:40	Flames to 2.5m cladding wall main face.
7:55	Hearth surround away. Drips in collapse area
13:45	Hearth surround away
15:27	Tile away 0m cladding wall main face
16:07	Tile away cladding wall main face 0.5m
17:13	Tile away cladding wall main face 0.5m
17:35	Tile away cladding wall main face 0.5m
17:55	Tile away cladding wall main face 0.6m
18:38 – 19:18	Tiles away cladding wall main face
19:37	Tile away cladding wall main face to 1m
20:07	Flames to 3.5m cladding wall main face
21:00	Crib starts to collapse
21:15	Tile falls away cladding wall main face
21:33 – 22:12	Tiles fall away cladding wall main face to 2m
23:10 – 24:04	Tiles fall away cladding wall main face to 2.5m
24:11 – 24:44	Tiles away cladding wall main face to 3m
24:50	Tiles away cladding wall main face right hand side at 0m
25:46	Flames to 4m cladding wall main face
25:07 – 27:11	Tiles away to 3.5m cladding wall main face
28:00 – 28:22	Tiles away to fire break 2nd level
30:00	Crib Extinguished
30:01	Continued burning on cladding wall main face to 3.5m
60:00	Test ends

5 Post-test damage report

5.1 External Layer

A photograph of the damage to the system is shown in Figure 16.

5.2 Insulation Layer

The condition of the insulation beneath the terracotta rainscreen after the test is shown in Figure 17. There was heat damage to the majority of the tiles between the first and second level fire breaks on the main face of the wall, as can be seen in the figure, and there was slight damage to the tiles above the second level fire break. It was noted that the insulation layer continued to burn past after the crib was extinguished with combustion reaching the fire barrier at the second level of the construction.

5.3 Collapse

Terracotta rain screen panels began to detach from the systems at 15:27 (minutes:seconds) and continued to 28:22 (minutes:seconds) after ignition of the crib.

6 Reference

1. BS 8414-2:2005, 'Fire Performance of External Cladding Systems – Part 2: Test method for non-load bearing external cladding systems fixed to and supported by a structural steel frame', British Standards Institute, Chiswick, 2005.

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7 Figures

Figure 1. The system prior to testing

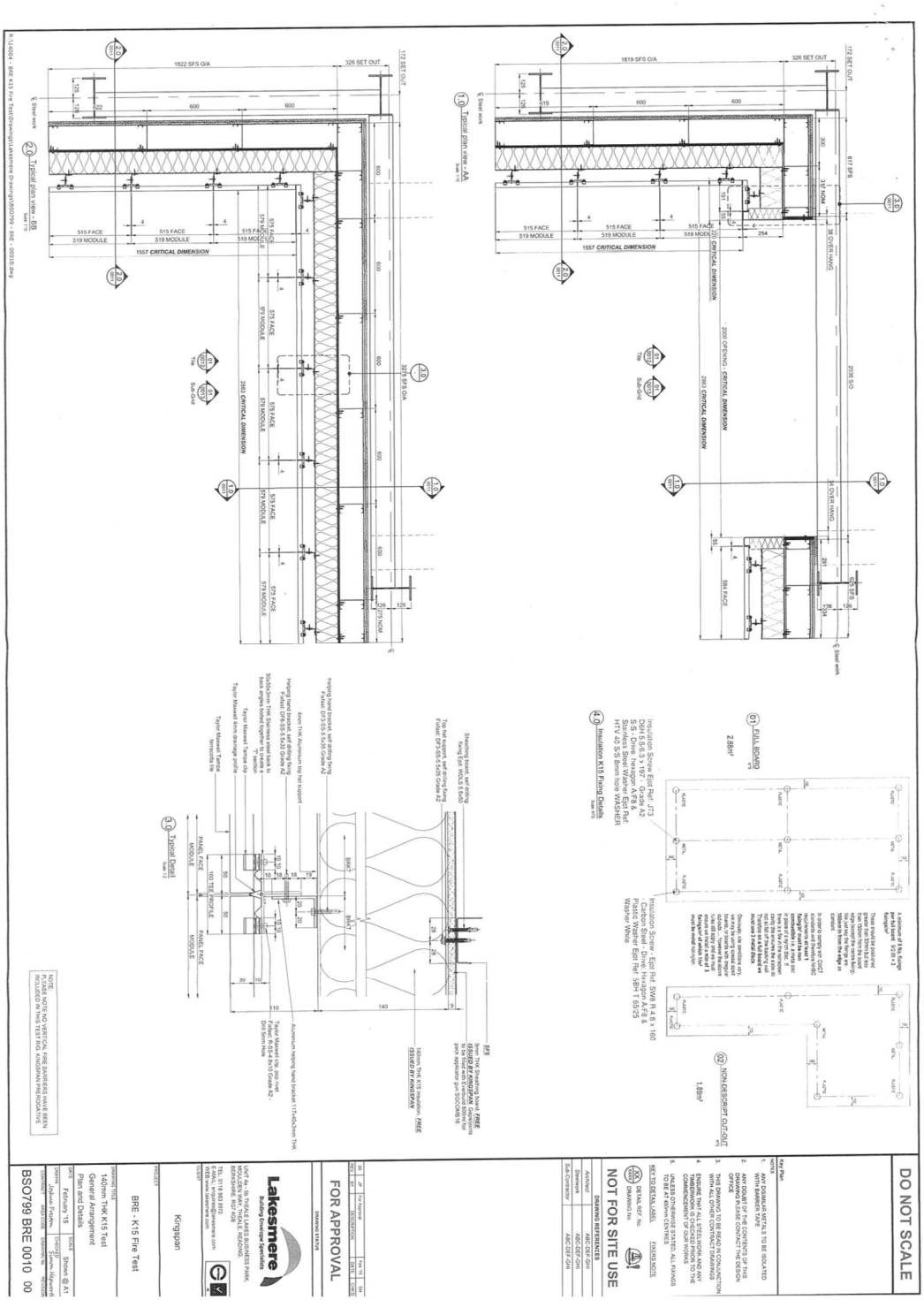

Figure 2. Plan section of the system showing the key layers of the cladding system

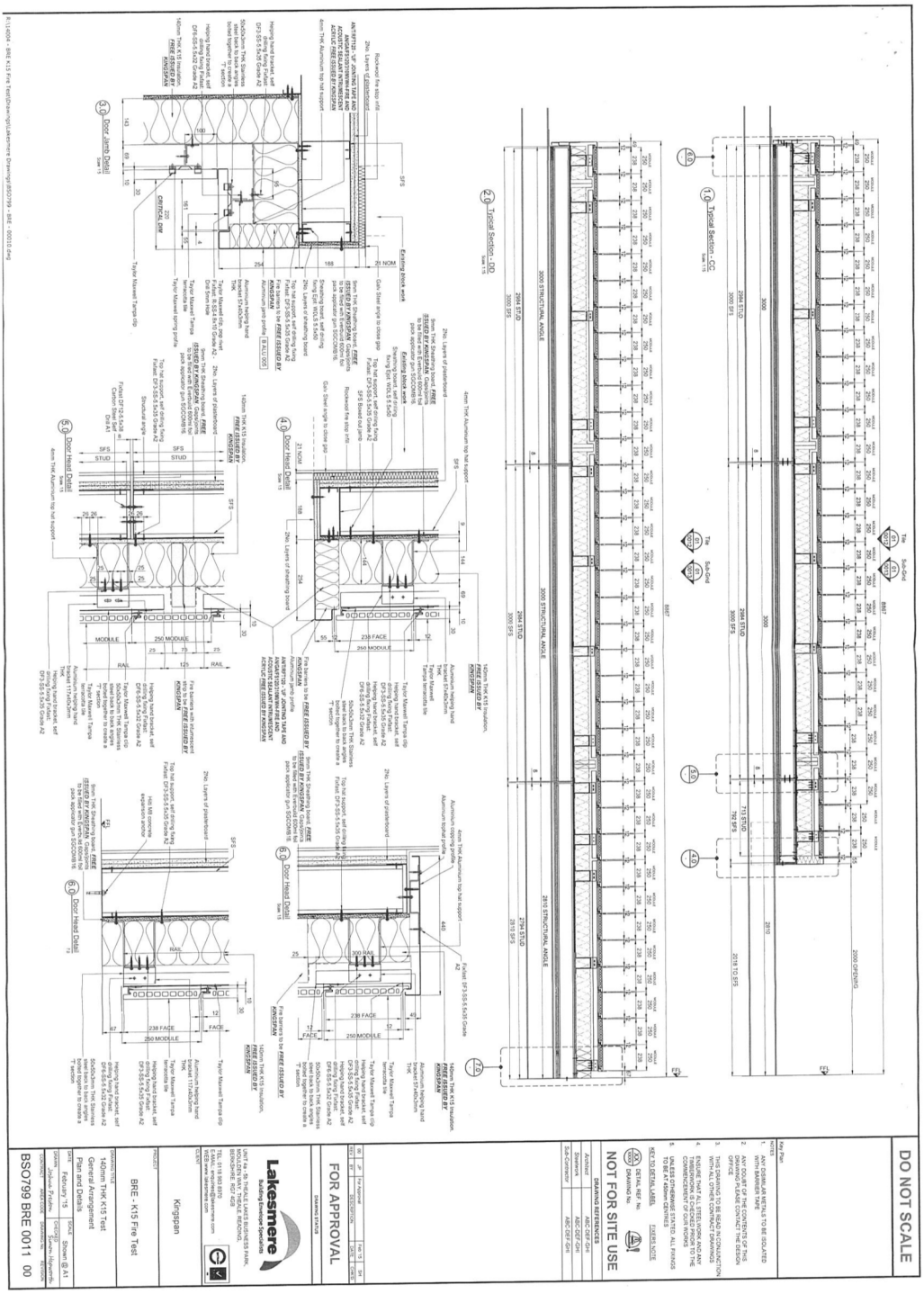

Figure 3. Vertical section of the system showing the key layers of the cladding system

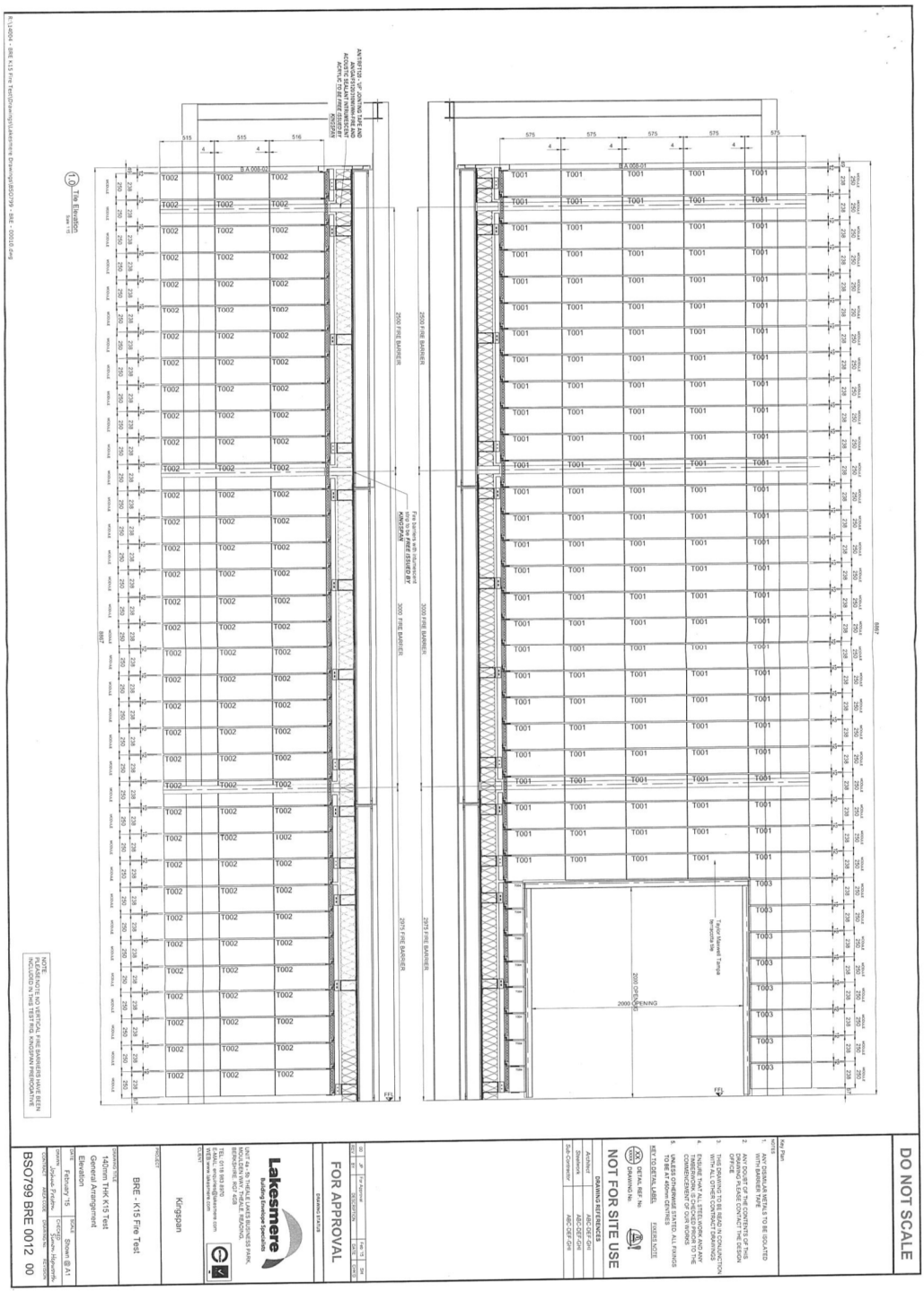

Figure 4. Construction of the system showing the layout of the Terracotta tiles

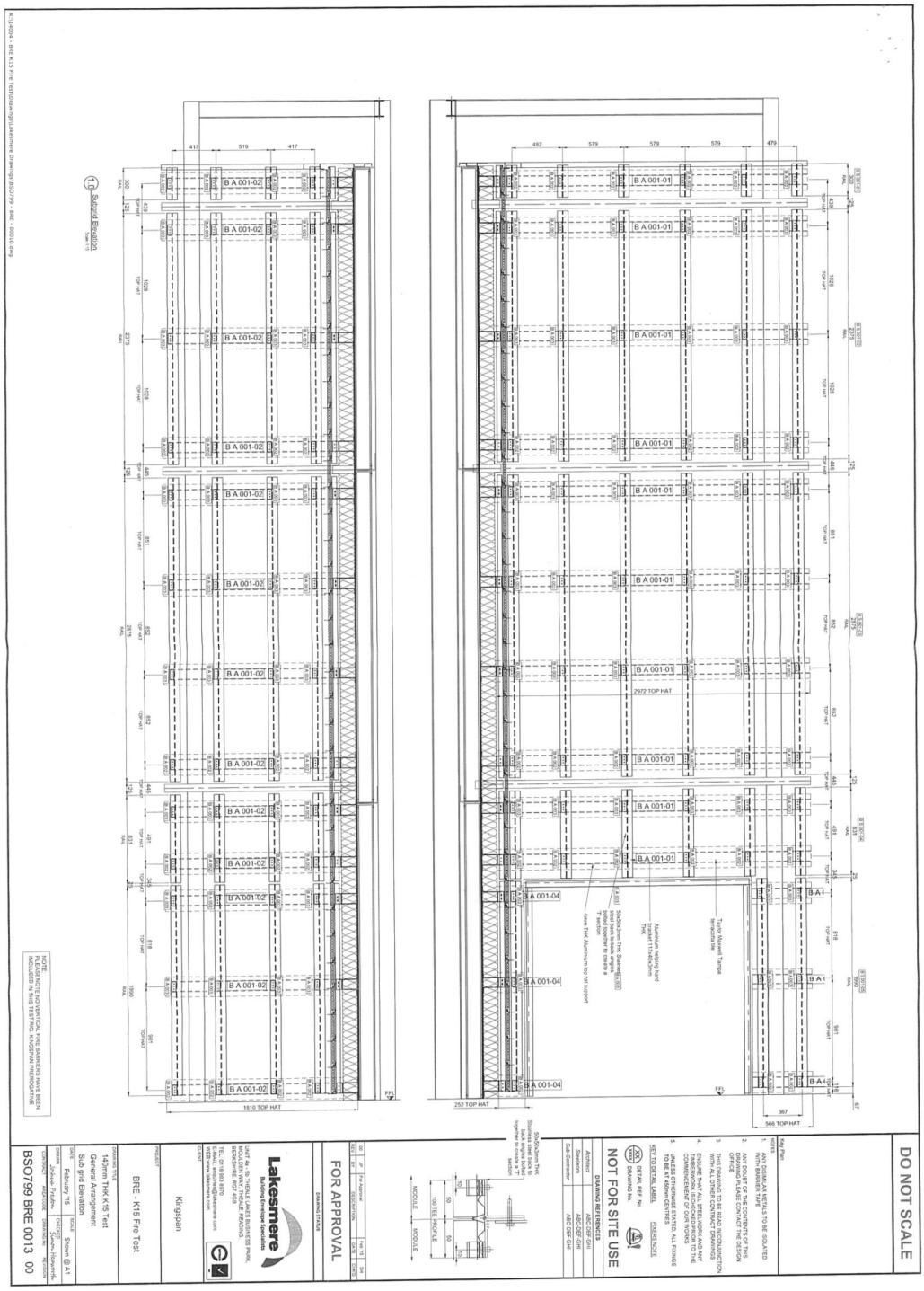

Figure 5. Construction of the system showing the layout of the structural steel frame

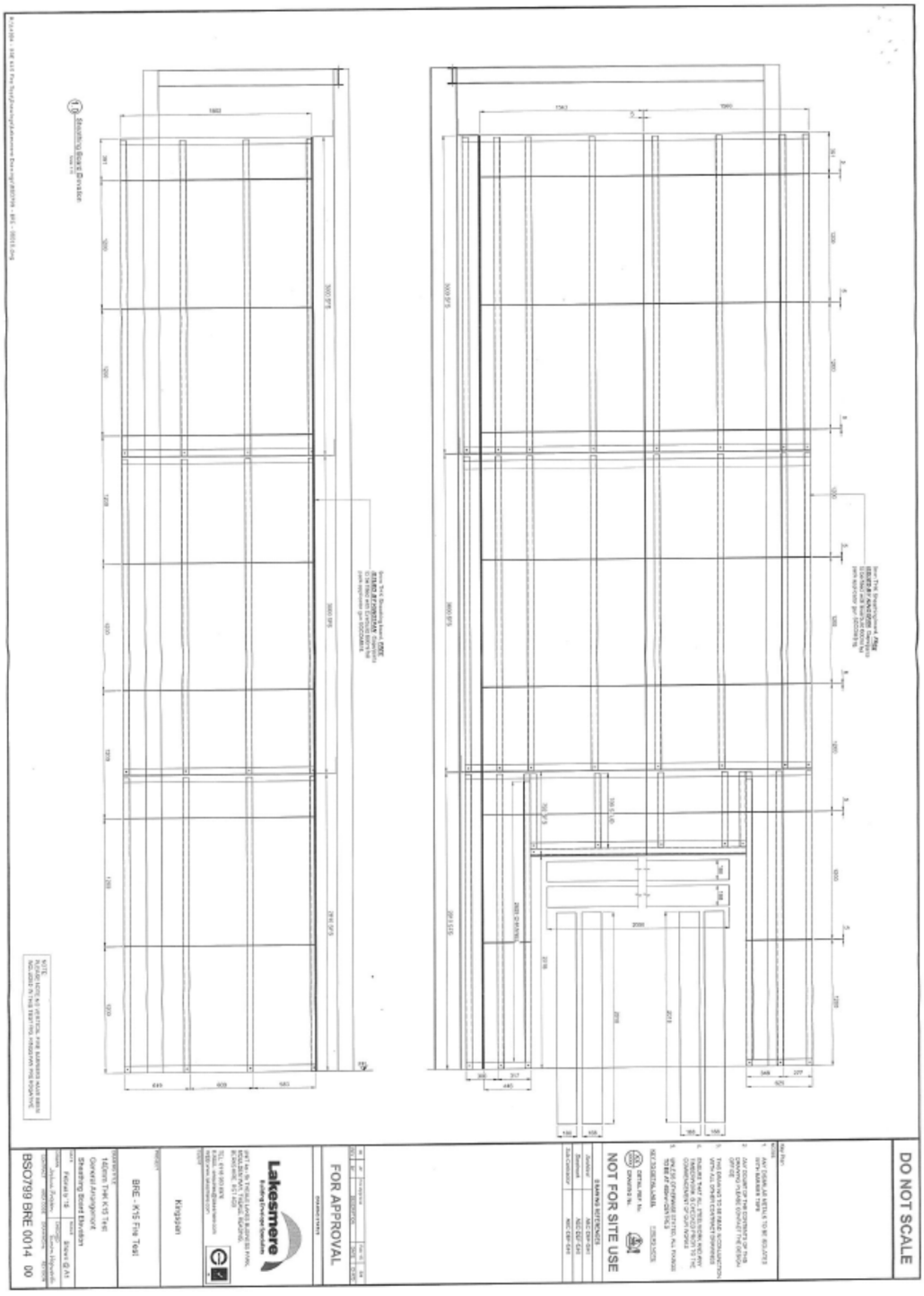

Figure 6. Construction of the system showing the layout of the cement particle sheathing board

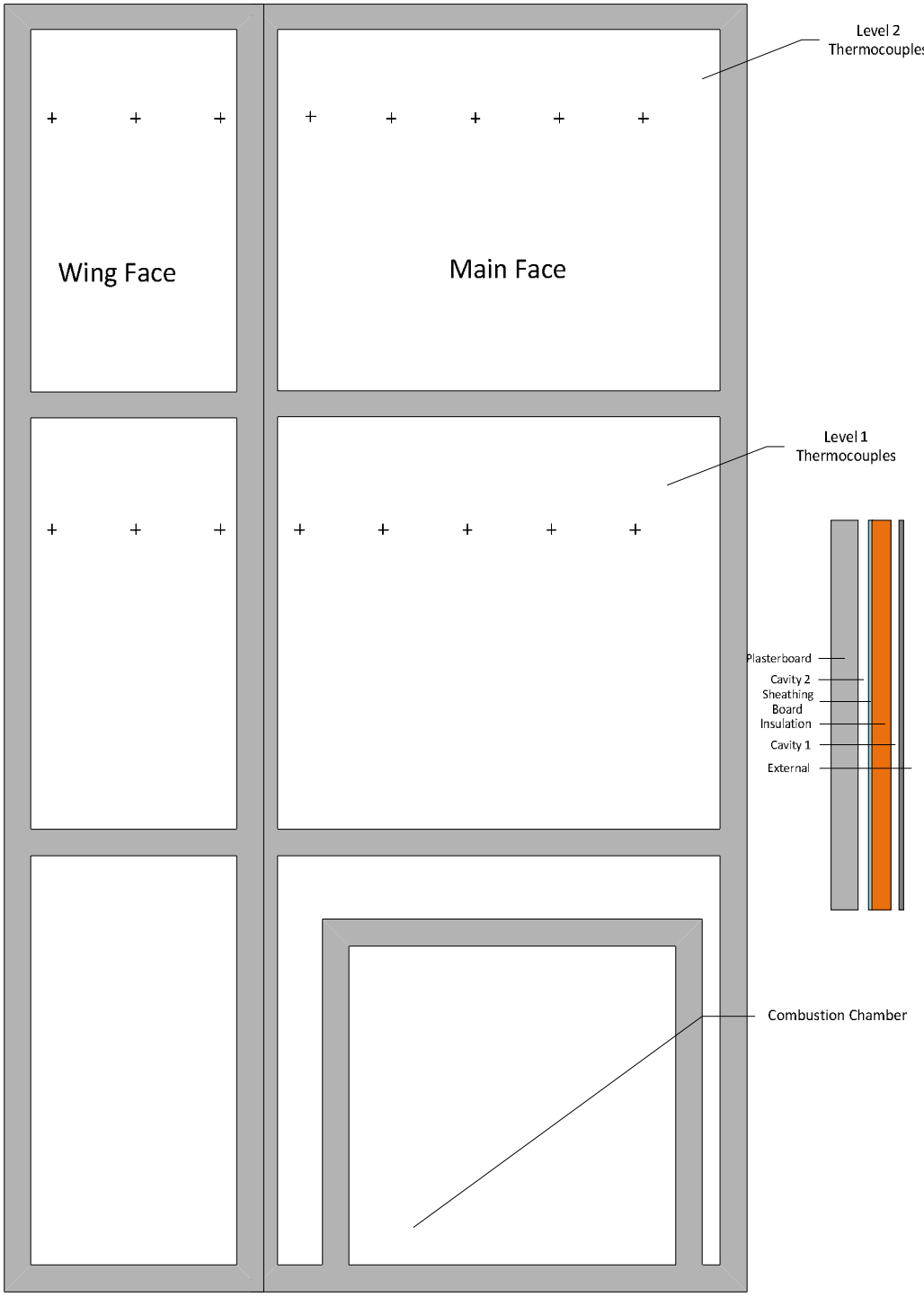

Figure 7. Locations of thermocouples used (schematic only)

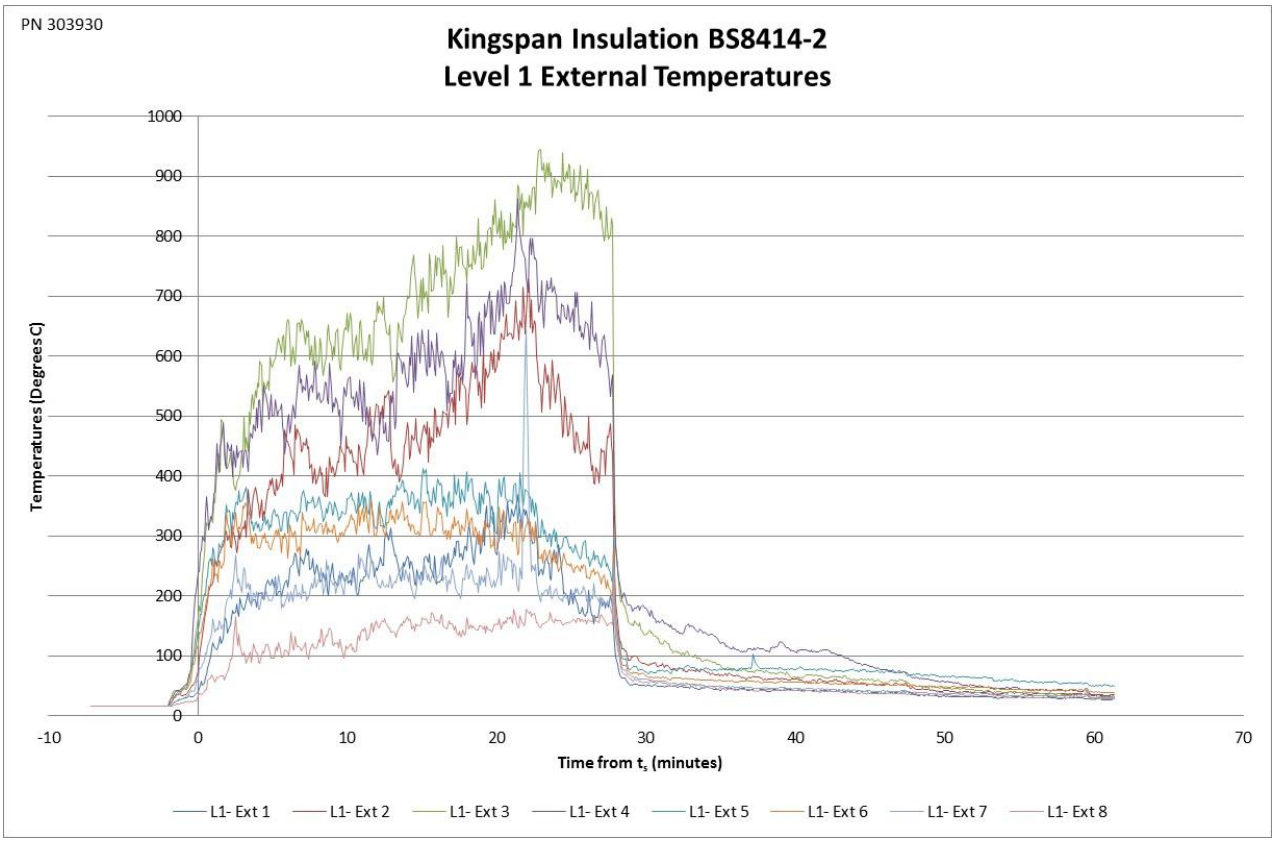

Figure 8. Temperatures Level 1 External

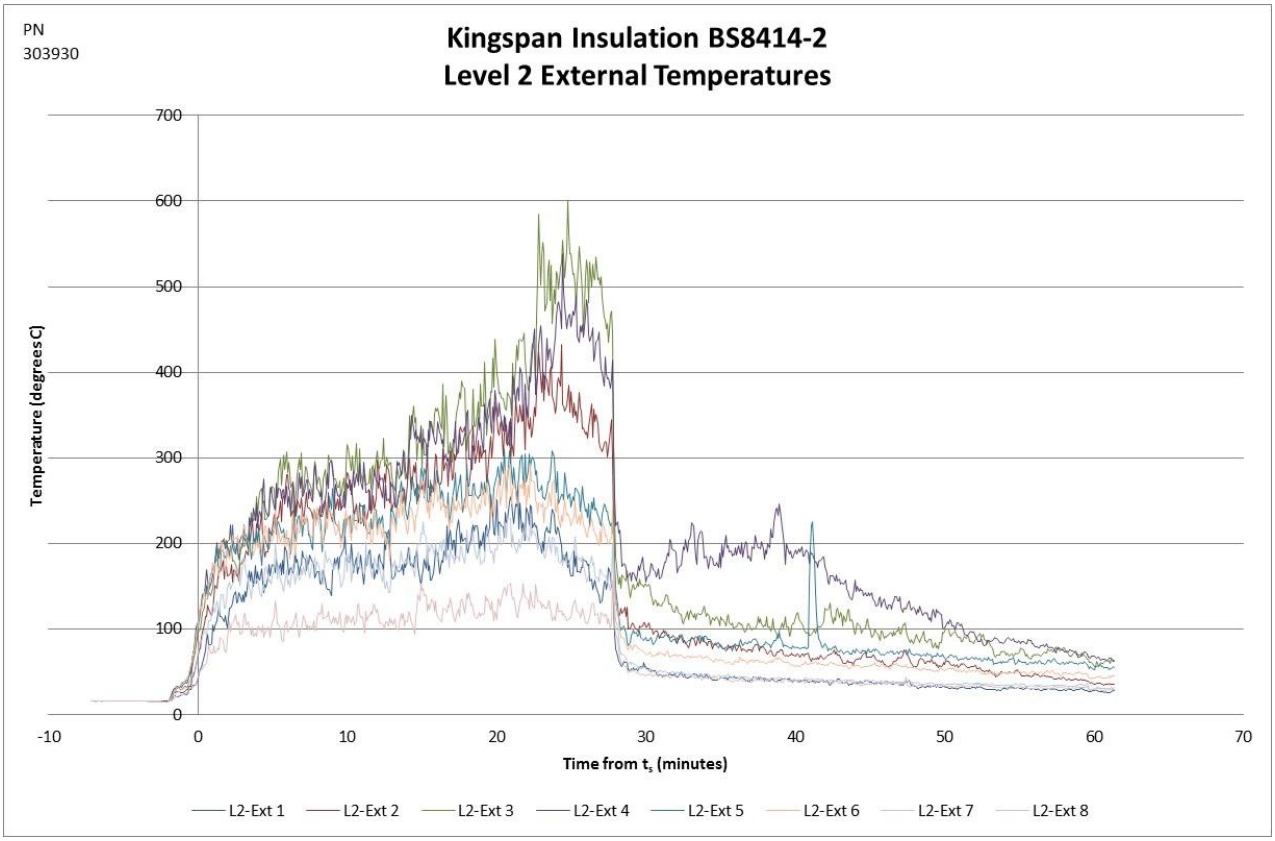

Figure 9. Temperatures Level 2 External Temperatures

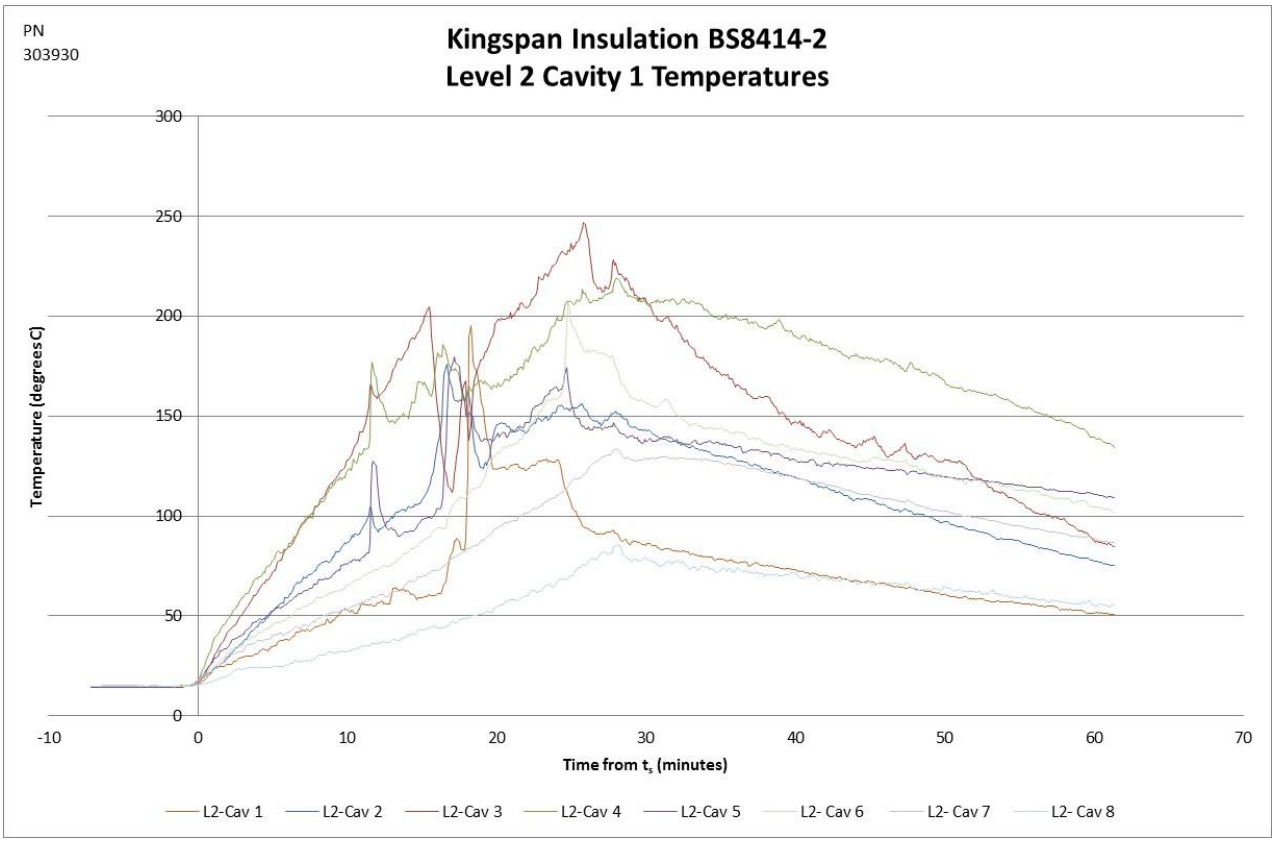

Figure 10. Temperatures Level 2 Cavity 1

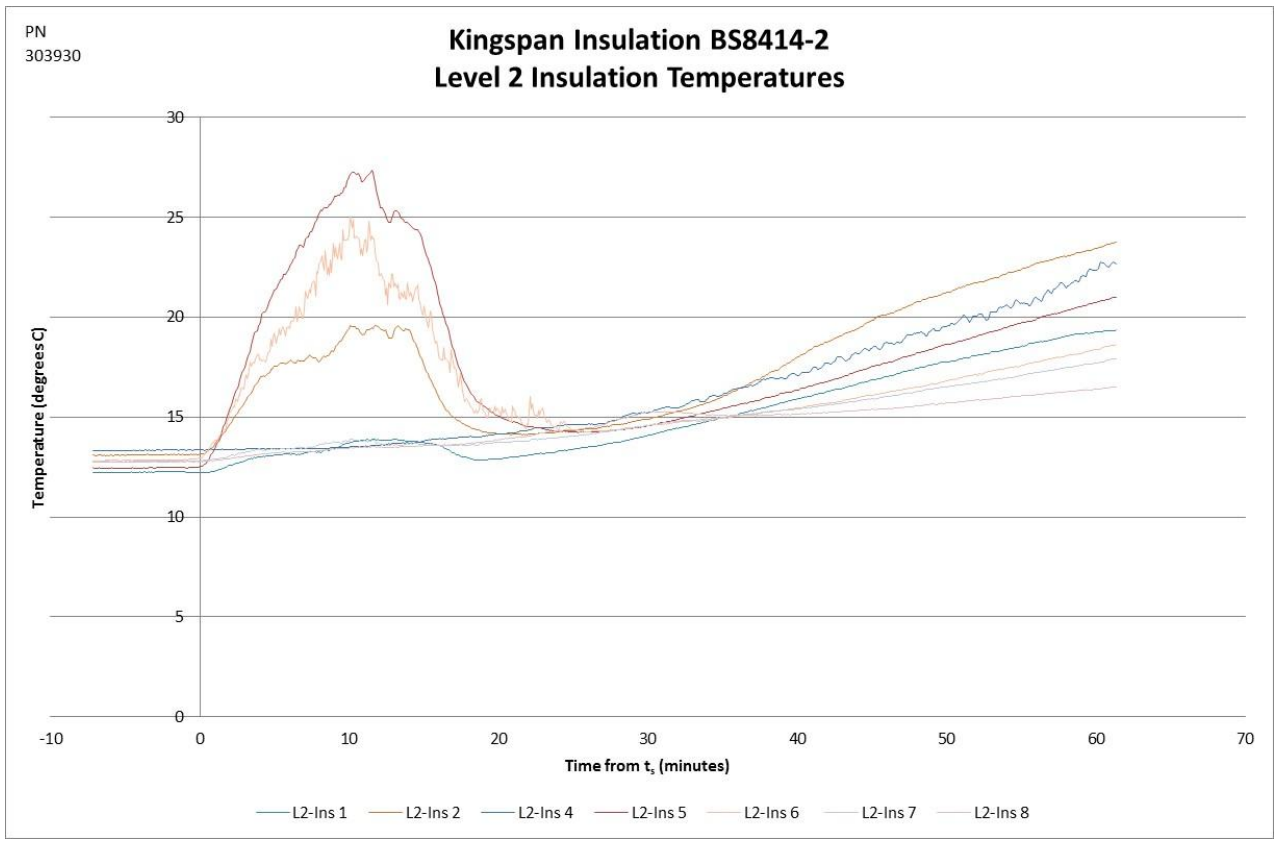

Figure 11. Temperatures Level 2 K15 Insulation.

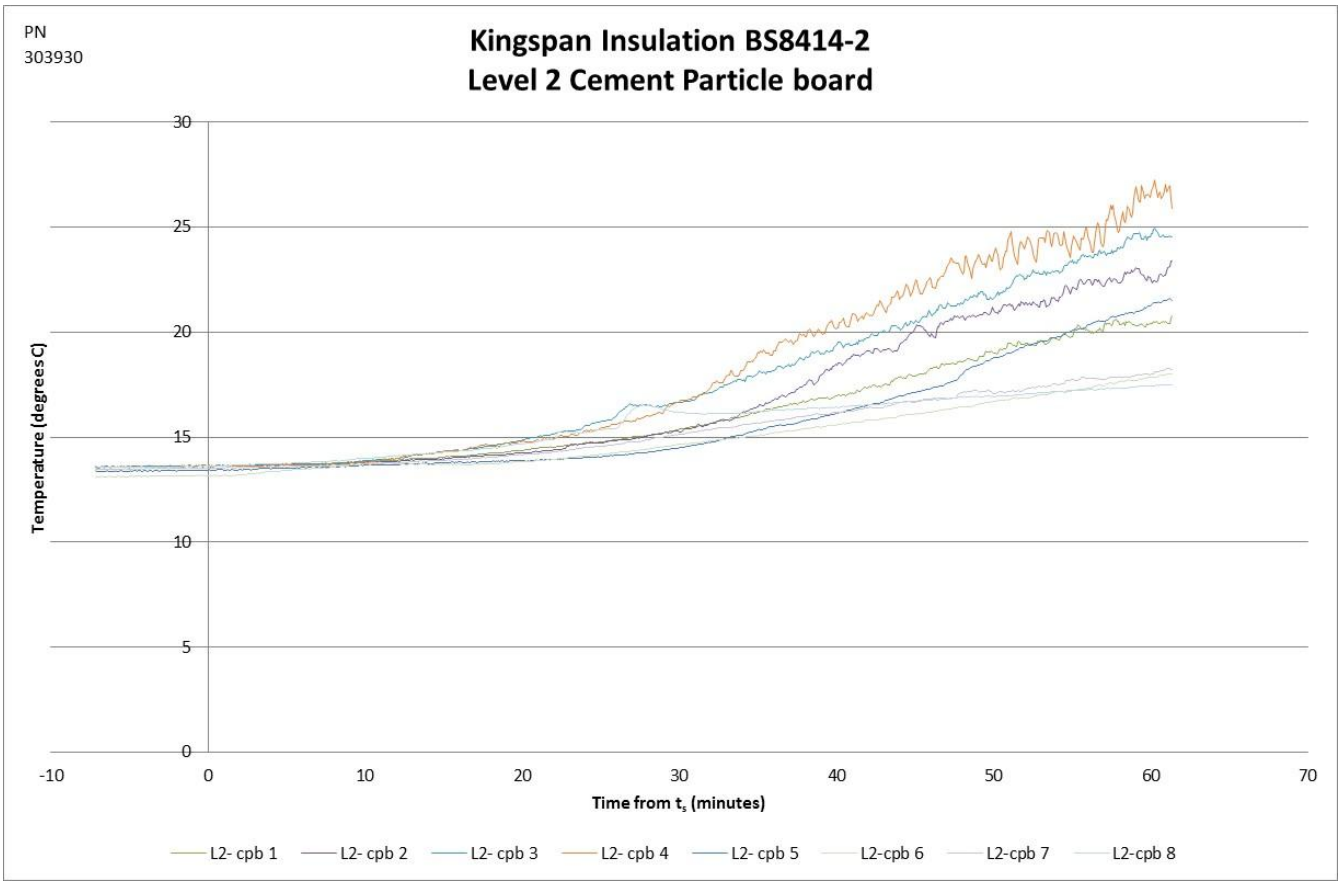

Figure 12. Temperatures Level 2 Cement Board

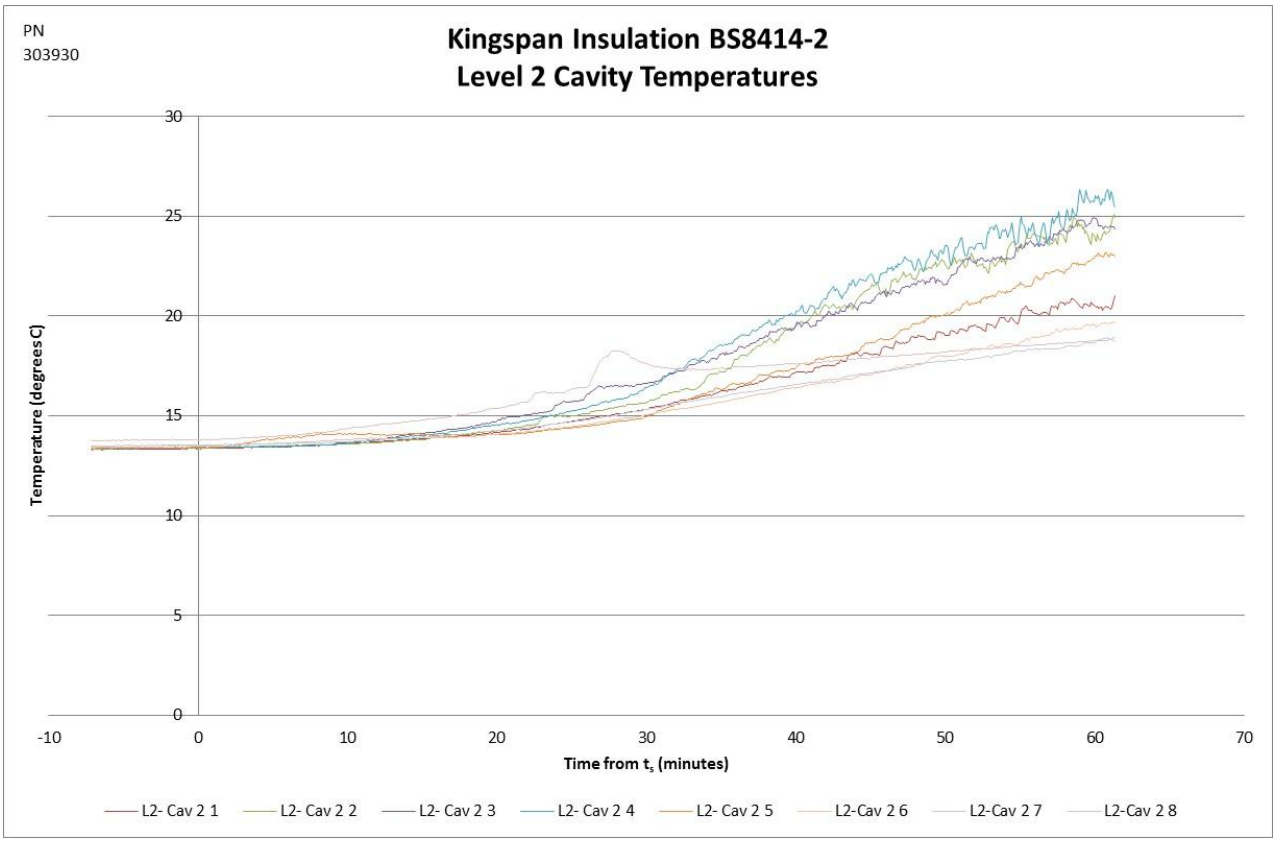

Figure 13. Temperatures Level 2 Cavity 2

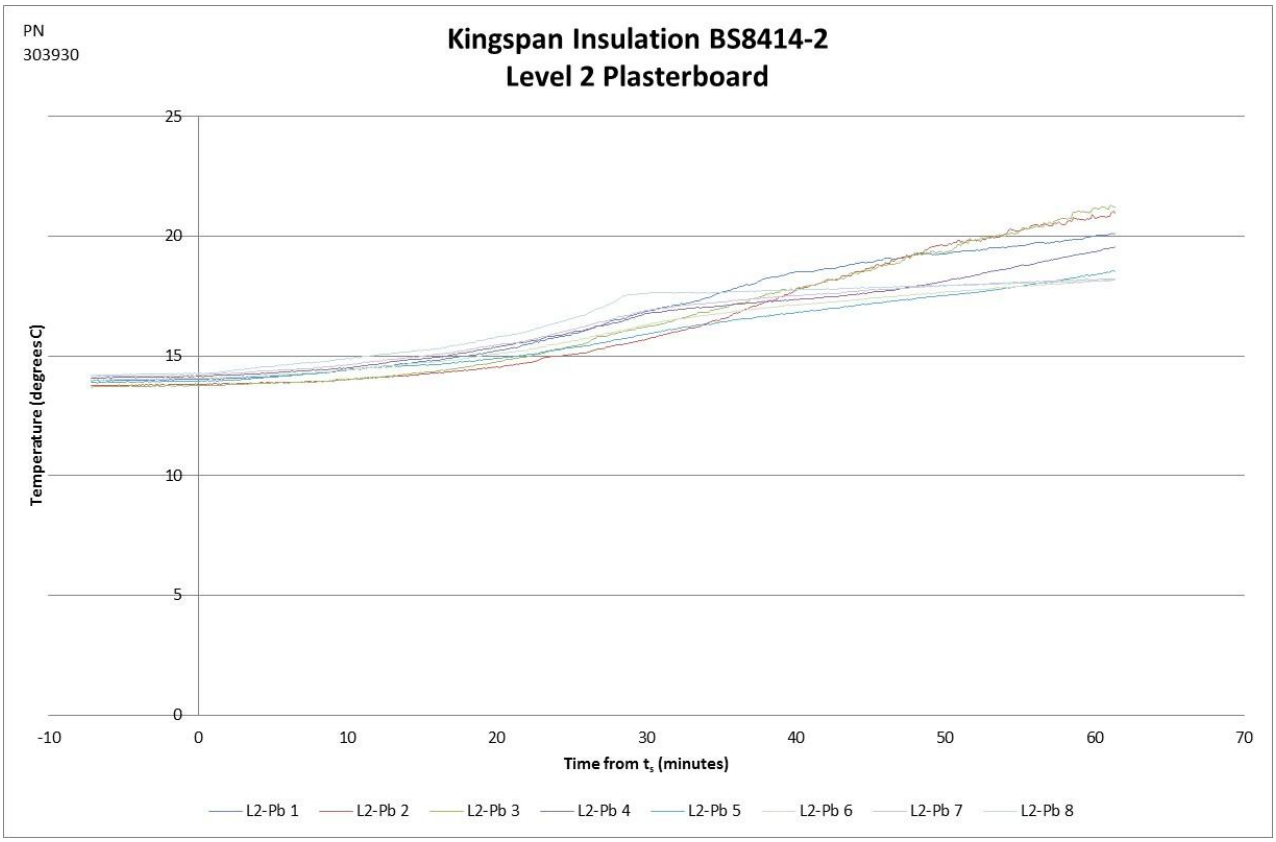

Figure 14. Temperatures Level 2 Plasterboard.

Figure 15. Cladding system during the test.

Figure 16. Photograph showing the condition of the cladding system post-test (Decorative Layer Full height).

Figure 17. Photograph showing the condition of the insulation layer of the System post-test (Decorative layer removed)

Report Ends