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FIRE PERFORMANCE OF EXTERNAL THERMAL INSULATION - CLASSIFICATION REPORT No EUI-18-000081A

1. INTRODUCTION

This classification report defines the classification assigned to Dri-Design with K-Roc Rainscreen Slab in accordance with the procedures given in BS 8414-2-2015+A1-2017 and BR 135 third edition 2013.

FIRE PERFORMANCE OF EXTERNAL THERMAL INSULATION CLASSIFICATION IN ACCORDANCE WITH BS 8414-2-2015+A1-2017 and BR 135 third edition 2013.

Sponsor:	KINGSPAN Limited
Prepared by:	Efectis UK/Ireland Ltd
System name:	Dri-Design with K-Roc Rainscreen Slab
Classification report No.:	EUI-18-000081A
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2. DETAILES OF CLASSIFIED SYSTEM

Technical data and drawings concerning the sample and its composition have been supplied by the sponsor who attests their accuracy.

All test materials were supplied and installed by the sponsor. Efectis UK/IRE were not involved in the sample selection process and therefore cannot take any responsibility for the relationship between samples supplied for testing and product placed on the market.

2.1. GENERAL

2.1.1. Substrate

The system, Dri-Design with K-Roc Rainscreen Slab, is described below.

2.1.2. Description of system

Based on the information provided by the test sponsor, the materials as used on the as-built façade system are given in the following table.

Material	Reference	Composition	Characteristics	Supplier
Steel Formed Sections - studs	Steel Formed Sections – Code: C100060120	gauge steel	100 mm × 50 mm × 1.2 mm thick	Steel Formed Sections
Steel Formed Sections – Head Track	Steel Formed Sections – Code: U104067180	gauge steel	104 mm × 50 mm × 2 mm thick	Steel Formed Sections
Steel Formed Sections –Base Track	Steel Formed Sections – Code: U104055120	gauge steel	104 mm × 50 mm × 1.2 mm thick	Steel Formed Sections
Insulation fitted within the steel frame	Omni Fit SLAB	Glass mineral wool	100 mm thick Reaction to fire: A1	KNAUF
Vapour/Air control barrier	AirGuard	PP with a Ethylene-Butylacrylate Copolymer coating	0.3 mm thickness Reaction to fire: E	DuPont
Tape for sealing joints of membranes	Tyvek Acrylic	made of durable Tyvek HDPE and acrylic adhesive	White colour	DuPont
Plasterboards of non-exposed face (no. 2 layer)	WallBoard	Gypsum board with ivory paper face	2400 mm x 1200 mm x 12.5 mm thick Reaction to fire: A2	KNAUF
Sheathing Board	Y-Wall	Calcium Silicate Board	2400 mm x 1200 mm x 12 mm thick	RCM
Vapour control tape	Cortex 0750	EPDM membrane	Thickness: 0.75 mm Reaction to fire: E	OBEX
Underlay membrane	Tyvek FireCurb	flash-spun-bond HDPE with transparent halogen-free flame retardant acrylic lacquer	0.175 mm thickness Reaction to fire: B-s1, d0	DuPont

Horizontal fire barriers	Siderise RH25G 90/30	Non-combustible stone-wool lamella core, with reinforced aluminium foil face c/w intumescent	75 mm x 273 mm Reaction to fire: A1	Siderise
Vertical fire barriers	Siderise RV 90/30	Non-combustible stone-wool lamella core, with reinforced aluminium foil face	75 mm x 273 mm Reaction to fire: A1	Siderise
Helping hand brackets c/w iso-pad sheets	KSF-B-S-220	Made of aluminium EN-AW 6060 T68	Bracket height 220 mm	KSF
Insulation of exposed face (no. 2 layer)	Kingspan K-Roc Rainscreen Slab	Soft and rigid stone mineral wool slab	100 mm thickness Reaction to fire: A1	Kingspan
Rails	a) 'T' and 'L' shape profiles b) Omega profiles c) Z profiles	Aluminium	-	-
External façade cladding	Benchmark Dri-Design cassettes	Aluminium	2 mm thickness Face colour: PPC Dark Copper Aluminium has Class 1 surface spread of flame to BS 476-7:1987, and are Class 0, as defined by building regulations	Kingspan
Flashings and closures	-	Aluminium	2-5 mm thickness	-
Screws used for installation of the frame	CFC26 Tek Screws	Stainless Steel	5.5 mm x 25 mm	-
Screws for fixing the frame on the concrete slabs	Multi-Monti-S-7.5x75	Galvanised screw	7.5 mm x 75 mm	-
Screws for fixing plasterboards on the frame	SXS/18-S16-5.5x41A4	-	5.5 mm x 41 mm at 150 mm centres	-
Screws for fixing sheathing boards on the frame	SXS/18-S16-5.5x41A4	-	5.5 mm x 41 mm at 150 mm centres	-
Screws for fixing the hand brackets on the sheathing boards	SX5/38-S16-5.5x61A4	-	5.5 mm x 61 mm	-
Screws for fixing the rail system	SX5/8-S16-5.5x31A4	-	5.5 mm x 31 mm	-
Rivets used for cladding the cassettes on the rail system	SSAL 4818	-	4.8 mm x 18 mm	-
Screws for fixing flashings	SX5/8-S16-5.5x31A4	-	5.5 mm x 31 mm	-
Screws for fixing closure and pod frame of combustion chamber	SX5/18-S16-5.5X41A4	-	5.5 mm x 41 mm	-

2.2. INSTALLATION SEQUENCE

2.2.1. Frame

The steel frame was constructed using 'C' section channel stud reference C100060120 (STEEL FORMED SECTIONS). Studs of dimensions 100 mm x 50 mm x 1.2 mm were fixed to the head and the base track at 300 mm and 600 mm centres using screws reference CFC26 Tek Screws of Ø 5.5 mm x 25 mm dimensions. The head track and the base track were made using rails references U104067180 and U104055120 (STEEL FORMED SECTIONS) respectively. The steel frame was fixed using fixings reference Multi-Monti-S-7.5x75 of Ø 7.5 mm x 75 mm dimensions to the concrete slabs of the testing rig, with outer face of the steel frame being 20 mm far from the face of the concrete slabs.

2.2.2. Insulation fitted within the frame

Within the steel stud frame earthwool insulation reference Omni Fit SLAB (KNAUF) of 100 mm thickness was fitted covering all areas between the stud frames.

2.2.3. Unexposed face of the facade

2.2.3.1. Vapour barrier

A vapour and air control layer reference AirGuard (DuPont) and thickness 0.3 mm was installed on the unexposed face of the frame. All joints and overlaps were covered using a tape reference Tyvek Acrylic tape (DuPont).

2.2.3.2. Plasterboard

Two layers of plasterboards reference WallBoard (KNAUF) dimensions 2400 mm x 1200 mm and thickness 12.5 mm were installed on top of the vapour barrier on the unexposed face of the frame. The plasterboards were fixed to the steel 'C' studs using fixings reference SXS/18-S16-5.5x41A4 of Ø 5.5 mm x 41 mm dimensions evenly spaced at approx. 150 mm centres. The two layers were installed with 600 mm overlaps.

2.2.4. Exposed face of the facade

2.2.4.1. Sheathing boards

One layer of sheathing boards reference Y-wall (RCM) of dimensions 2400 mm x 1200 mm and thickness 12 mm were clad on the exposed face of the frame using fixings reference SXS/18-S16-5.5x41A4 of Ø 5.5 mm x 41 mm dimensions. Screws were evenly spaced and fixed at 500-600 mm centres. Additionally, a vapour control sealing tape reference Cortex 0750 (OBEX) was used on the joints of sheathing boards and slabs for sealing the interface of slab edges.

2.2.4.2. Underlay membrane

An underlay membrane reference Tyvek FireCurb (DuPont) of thickness 0.175 mm was installed on top of the sheathing board layer. All joints and overlaps were covered using a tape reference Tyvek Acrylic tape (DuPont).

2.2.4.3. Fire stop barrier

Horizontal and vertical fire stop barriers were installed on the underlay membrane. The fire barriers reference Siderise RH25G 90/30 (Siderise) thickness 75 mm and width 273 mm were compressed by 10 mm by the cladding. They were fixed using specific system brackets.

A set of no. 3 vertical fire barriers were installed also on the sheathing board layer. Two of them were placed next to combustion chamber opening vertical sides (65mm from chamber opening to C/L) and the third one on the wing face of the façade system (180mm to C/L from the angle).

A set of no. 4 horizontal fire barriers were installed on the entire width of the facade and it's wing at height of:

2240 mm; above the floor level

2540 mm above the floor level in line with 1st concrete slab
5540 mm above the floor level in line with 2nd concrete slab
8605 mm above the floor level in line with 3rd concrete slab

2.2.4.4. Brackets

Brackets reference KSF-B-S-220 Helping Hand brackets (KSF) were installed on the sheathing board layer using screws reference SX5/38-S16-5.5x61A4 of Ø 5.5 mm x 61 mm dimensions. Those brackets were combined with isolation pad sheets placed between the bracket and the sheathing board. On the main face the horizontal spacing between the brackets varied between 290 mm (up to combustion chamber full height level) and 600 mm (above combustion chamber level) and on the wing wall the spacing between the brackets was approximately 600 mm. The vertical spacing between the brackets varied between 100 mm (where the 1st horizontal barrier was installed on the main face) and 850 mm on the rest areas.

2.2.4.5. Insulation

Insulation combining two layers of mineral wool reference K-Roc Rainscreen Slab and thickness 100 mm was fixed to the sheathing board layer, over the helping hand brackets, following pattern as specified by manufacturer's details.

2.2.4.6. Outer face

On the helping hand brackets, aluminium rails of 'T' and 'L' shape profiles were fixed using screws reference SX5/8-S16-5.5x31A4 of Ø 5.5 mm x 31 mm dimensions.

For supporting the outer face panels, horizontal Omega profiles reference A-H12202520 of dimensions 122mm x 25mm x thickness 2mm and 'Z' profiles reference A-Z08102525 of dimensions 40 mm x 25 mm x 40 mm of thickness 5 mm were fixed on the aluminium 'T' and 'L' profile rails using screws reference SX5/8-S16-5.5x31A4 of Ø 5.5 mm x 31 mm dimensions.

Finally, the outer face cassettes reference Dri-Design cassettes (Kingspan) were clad on the Omega fixed to the Z profiles using rivets reference SSAL 4818 of Ø 4.8 mm x 18mm dimensions. The cassettes were made by aluminium having thickness of 2 mm. The colour of the cassettes was PPC Dark Copper as specified by the manufacturer. All cassettes were in dimensions as shown in Figure A1 of Appendix A according to sponsor's drawing.

2.2.4.7. Air gap

A continuous air gap layer of 38 mm was managed between the insulation and the inside of the Omega rails. The air gap was blocked where the vertical fire barriers were installed and reduced to 25 mm in the location of the horizontal fire barriers.

2.2.5. Flashings and closures

The side edges of the façade system were closed with 'L' shape aluminium closure flashing thickness 2 mm. The flashings were secured directly on the sheathing board layer using screws reference SX5/8-S16-5.5x31A4 of Ø 5.5 mm x 31 mm dimensions, running along the full height of both sides. The dimensions of the flashings were 263 mm x 50 mm.

The top edge of the façade system was closed using an aluminium top cap flashing of 'L' shape with dimensions 295 mm x 76 mm and thickness 2 mm. The top cap flashing was secured on the top concrete slab using 'L' shape channel and screws reference SX5/8-S16-5.5x31A4 of Ø 5.5 mm x 31 mm dimensions.

In line with the opening of the combustion chamber a frame made of double layer plasterboards reference WallBoard (KNAUF) thickness 15 mm was installed on the steel stud construction using screws reference SX5/18-S16-5.5X41A4 of Ø 5.5 mm x 41 mm dimensions. The plasterboards were extended along the thickness of the unexposed face and the steel frame, being flushed with the exposed face of the sheathing board layer.

A pre-fabricated aluminium pod frame of 'L' shape thickness 5 mm was fixed onto the sheathing board layer with screws reference SX5/18-S16-5.5X41A4 of Ø 5.5 mm x 41 mm dimensions. The dimensions of the pod frame were 305 mm x 75 mm.

2.2.6. Joints

The cassette panels were installed so that there was a vertical joint central to the combustion chamber running the full height of the system. The width of the joint was 15 mm.
Horizontal joints of 14 mm width were resulted by the way the cassettes were clad, with one of them being at 2400 mm above the combustion chamber.
At each floor level, a movement/expansion joint was managed on the slab edges.

2.3. SYSTEM IDENTIFICATION OF REFERENCED PARTS

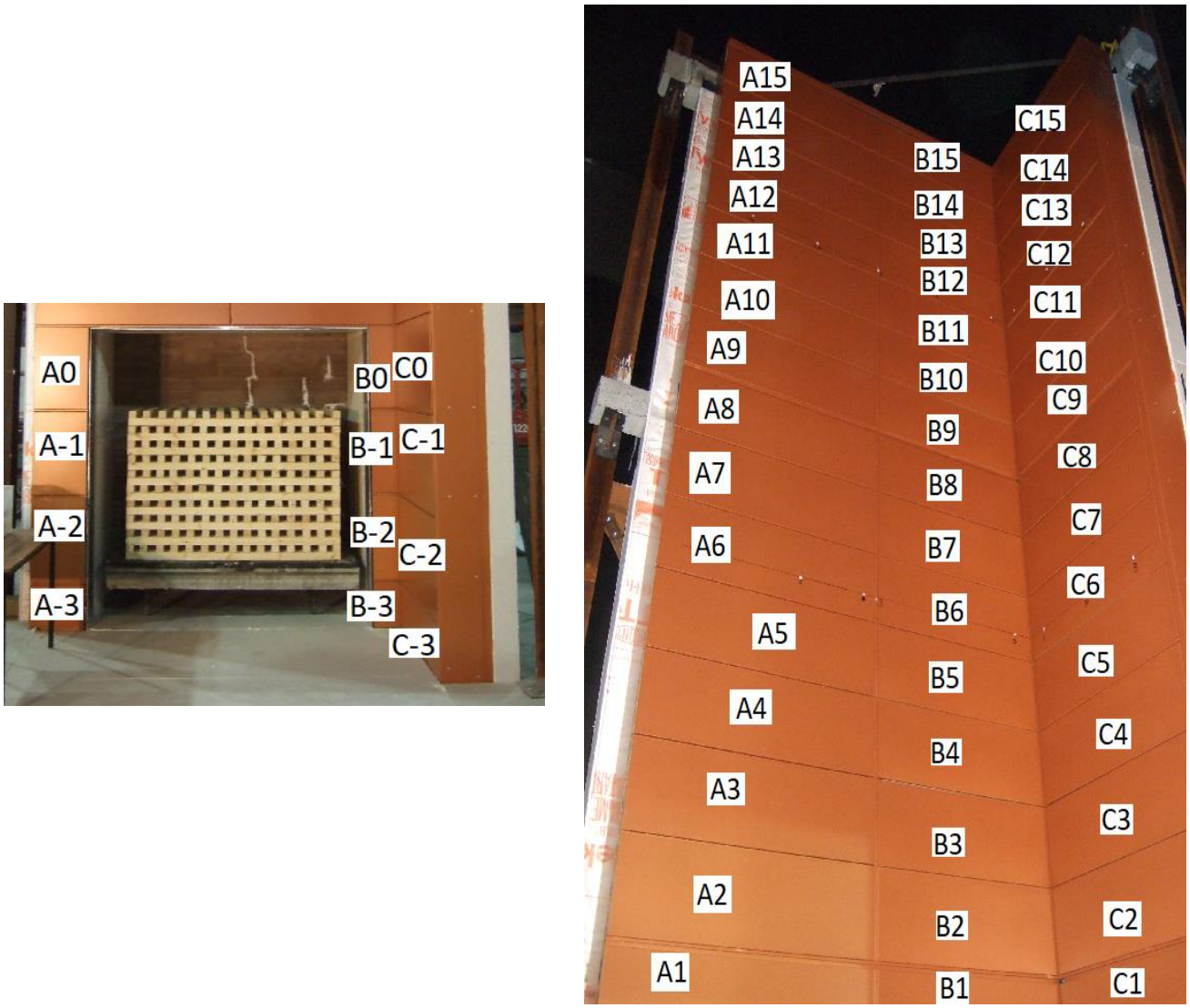

Figure 1. System photos before testing for reference of identified area parts.

3. REPORTS AND RESULTS IN SUPPORT OF THIS CLASSIFICATION

3.1. REPORTS

Name of Laboratory	*Name of sponsor*	*Report ref. no*	*Test method and date*
EFECTIS UK/IRE	KINGSPAN Limited	EUI-18-FF-000081A	BS 8414-2-2015+A1-2017

3.2. RESULTS

3.2.1. Fire spread

Fire-spread start time, t_s = 01:18 min

Test method and test number	*Parameter(s)*	*No. Tests*	*Results*	
			Fire spread test result time, ts (min)	*Compliance with parameters in Annex B of BR135:2013*
BS 8414-2-2015+A1-2017	**External fire spread**	**1**	**> 15 minutes**	**Compliant**
	Internal fire spread (cavity layer)		**> 15 minutes**	**Compliant**
	Internal fire spread (insulation layer)		**> 15 minutes**	**Compliant**
	Internal fire spread (sheathing board layer)		**> 15 minutes**	**Compliant**
	Internal fire spread (insulation within frame layer)		**> 15 minutes**	**Compliant**
	Internal fire spread (plasterboard layer)		**> 15 minutes**	**Compliant**

3.2.2. Mechanical performance

The cladding system has been examined when cooled (within 24 h of the test). Examination compromised external surface and internal layers. In more detail, the performance of the cladding system is described in the following subsections.

3.2.2.1. Outer face Dri-Design cassettes

On the main face of the cladding system, cassette panels A-3 to A0 and B-3 to B0 remained in place without any major damage. Only some discolouration was observed on B0 panel.
Major damage was observed on panels A1 to A8 and B1 to B8. Most of this area was melted and all the panels were severely damaged as described more extensively below:

Panels: A1, B1 were 80% destroyed
Panels: A2, B2 were 70% destroyed
Panels: A3, B3 were 55 - 60% destroyed
Panels: A4, B4 were 45 - 50% destroyed
Panels: A5, B5 were 40 - 45 % destroyed
Panels: A6, B6 were 30 - 35% destroyed
Panels: A7, B7 were 10 - 20% destroyed
Panels: A8, B8 were up to 5% destroyed

The cassette panels A9 to A15 and B9 to B15 were discoloured but they remained in place.

On the wing face, major discolouration was observed on C-2 to C8. Partial damage visible on cassette panels C1 and C2 with some cracks on them. Panels C9 to C15 remained in place without further damage or discolouration.

3.2.2.2. Helping hand Brackets and Railing system

The helping hand brackets of the main face, supporting the insulation and the railing system, were melted on the centreline above the combustion chamber up to the height of the 2nd fire barrier. Rest were intact and in place after removing the cassette panels and only some discolouration up to a height of 1.5 m above the combustion chamber. On the wing face all brackets were in place.

On the main face, the rail system supporting the cassette panels was completely damaged and melted on the area confined in between the vertical fire barriers and vertically from combustion chamber up to the 3rd horizontal fire barrier. The rest of the rails were in place after removing the cassette panel and only minor discolouration was observed on them just above the 3rd fire barrier and those close to the corner. On the wing face, all rails were in place with minor discolouration on those behind panels C-1 to C3.

3.2.2.3. K-Roc Rainscreen Slab insulation

On the main face, the K-Roc Rainscreen slab insulation was mainly in place. Above the combustion chamber, contained between the vertical fire barriers and up to the 1st fire barrier height, parts of it fell down during test. Above the 1st fire barrier and up to height behind panels A3 and B3, major discolouration was observed. Up to level of A9-B9 panels, the insulation was slightly discoloured. Above this height, insulation remained without any damage or discolouration.
On the wing face, similar observations were made above the 3rd fire barrier, where the insulation was remained intact. On the area behind C-2 to C0 the slabs were discoloured slightly also. On the area between C1 and C8 there was major discolouration.

3.2.2.4. Fire barriers

The bottom horizontal fire barrier placed just above the combustion chamber on the main face of façade system, was activated during testing. After the end of the test it was still in place but completely damaged.
Same observation was made regarding the fire barrier of the same height on the wing face.

The 2nd horizontal fire barrier, which was placed in line with the bottom concrete slab, was activated during testing. After the end of the test it was still in place but completely damaged. Same observation was made regarding the fire barrier of the same height on the wing face.

The 3rd horizontal fire barrier, which was placed in line with the middle concrete slab, was not activated during testing. After the end of the test only some discoloration was visible on the underside of the barrier. Same observation was made regarding the fire barrier of the same height on the wing face.

The top horizontal fire barrier was intact and in place after test. Same was the fire barrier on the same height of the wing face of the system. Neither was activated during testing.

The vertical fire barriers remained intact, only discoloration was observed along the inside edges facing the centreline which was running across the full height above the combustion chamber. The fire damage on the main face of the façade system was contained within the bounds of the vertical cavity barriers running across the combustion chamber vertical edges. Same observation was made regarding the vertical fire barrier of the wing face.

3.2.2.5. Sheathing board layer

All boards were intact and no damage was observed.

3.2.2.6. Insulation within the frame

No damage was observed on the Omni Fit SLAB insulation which was fitted within the studs of the metal frame.

3.2.2.7. Plasterboards

No damage was observed to plasterboard layer installed on the supporting metal frame made from C studs.

3.2.2.8. Frame

No damage was observed on the metal frame of the façade system.

4. CLASSIFICATION AND FIELD OF APPLICATION

4.1. REFERENCE OF CLASSIFICATION

This classification has been carried out in accordance with BS 8414-2-2015+A1-2017 and BR 135 third edition 2013.

4.2. CLASSIFICATION

The element, Dri-Design with K-Roc Rainscreen Slab, described in this classification report and in the test report referenced in section 3.1 has been tested and met the performance criteria set in Annex B of BR135:2013.

4.3. FIELD OF APPLICATION

This classification is valid only for the system as installed and detailed in this classification report and in the test report referenced in section 3.1.

5. LIMITATIONS

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

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.

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.

SIGNED

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