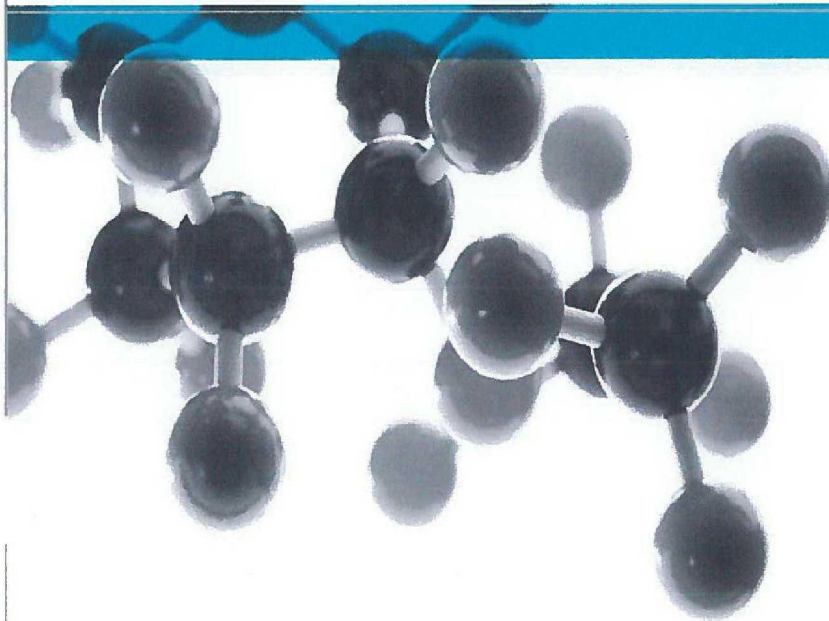


Assessment of the fire performance of external wall systems for use on high rise buildings as featured on the Middlewood Locks project



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A Report To: Celotex Limited

Document Reference: 383476

Reference: Middlewood Locks project

COMMENTS.

14 Aug 2017

EXECUTIVE SUMMARY

Objective To determine the compliance of insulated external wall systems and utilising Celotex RS5000 insulation system for use on multi-storey buildings with the requirements of the relevant warranty provider standards. The external walls are faced with alucobond aluminium rainscreen panel system and brickwork cladding.

Generic Description	
<p>The alucobond aluminium rainscreen panel system build up 1 comprises:</p> <ul style="list-style-type: none"> • 2 layers of 15mm British Gypsum Gyproc soundbloc plasterboard; • 1100 gauge polyethylene vapor control layer; • 100mm SFS frame system fully filled with; • 100mm mineral wool; • 12.0mm Knauf Windliner board; • Breather membrane (PROCTOR WRAPTITE SA); • 150mm PIR insulation (Celotex RS5000); • Aluminium helping brackets and rails fixed back to a supporting wall. ; • 48mm- 66mm non ventilated cavity; • At least 80mm PFC Corofil C450 Cavity Firestop as horizontal and PFC Corofil VFB Cavity Firestop as vertical cavity barrier ; • Aluminium rainscreen cladding system (Alucobond Plus) 	<p>The brick work system build up 2 comprises:</p> <ul style="list-style-type: none"> • 2 layers of 15mm British Gypsum Gyproc soundbloc plasterboard; • 1100 gauge polyethylene vapor control layer; • 100mm SFS frame system fully filled with; • 100mm mineral wool; • 12.0mm Knauf Windliner board; • 85mm PIR insulation (Celotex RS5000); • Fixation, brick ties; • Min 50 mm ventilated cavity; • At least 80mm PFC Corofil VFB Cavity Firestop as horizontal and vertical cavity barrier • 102.5mm brick facing.

VENTILATED CAVITY WITH INTUMESCENT CAVITY FIRE STOPS.

- PFC COROFIL VFB HORIZONTALLY & VERTICALLY.

COROFIL C450 VERTICALLY & COROFIL VFB HORIZONTALLY.

Report Sponsor Celotex Limited., Morland House, 15 Davy Court, Rugby, CV23 0UZ

Opinion We consider that the information reviewed in this document is sufficient to allow a conclusion to be drawn that the fire performance of the systems described will be sufficient to meet the requirements of the Building Regulations for England and Wales for External Wall Systems on high rise buildings and also the standards of NHBC (BCA Guidance Note 18 *Use of Combustible Cladding Materials on Residential Building*).

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SIGNATORIES

Responsible Officer Mostafa Jafarian * Certification Engineer

Authorised Janet Murrell* Technical Manager

* For and on behalf of **Exova Warringtonfire**.

Report Issued: 08 May 2017

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INTRODUCTION

Terms Of Reference

Exova Warringtonfire have been instructed by Celotex Limited, to assess the compliance of external wall systems to be used in multistorey buildings on the Middlewood Locks project to the requirements of the current Building Regulations for England and Wales following the guidance given in Approved Document B and to the standards of the relevant warranty provider. The purpose of this report is to provide the assessment of performance requested in Option 3 of the NHBC letter dated April 01 2015.

Introduction

The external wall constructions include the use of Celotex RS5000 (referred to hereafter as RS5000) as the insulation.

In buildings taller than 18m, insulation materials in external wall systems should be of limited combustibility to meet the contemporary design guidance of the Building Regulations. The general intent is that buildings with a storey at a height of more than 18m above the external access level cannot be easily reached by fire and rescue service equipment and personnel. Therefore the materials in the build-up of external walls in buildings over 18m should be provided with means of reducing fire spread risk.

For buildings in the Middlewood Locks project, this restriction is applicable. RS5000 insulation has been proposed to meet the thermal insulation performance within this construction. The RS5000 insulation product is based on polyisocyanurate (PIR) which is organic in nature and therefore classed as combustible. It therefore does not meet with the above fire strategy requirement given in the Building Regulations and are therefore required to undergo either a fire test to BS 8414 (Option 2) or a desktop study (Option 3) by NHBC in accordance with BCA Guidance Note 18 *Use of Combustible Cladding Materials on Residential Building*.

There is a need to assess these materials for suitability in these external wall systems and to look at the overall potential performance of the total system based on various fire test reports. For a combustible material to be used at heights of over 18m the guidance given in the Building Regulations for England and Wales are that it should have a fire performance of at least B-s3,d2 when classified to BS EN 13501-1 and in addition should be tested against BS 8414-2 and assessed against the requirements of BR 135.

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SUPPORTING DOCUMENTATION

The following reports and drawings have been used in this assessment of the external wall systems which are proposed for use on high rise buildings in the Middlewood Locks development project.

Product (Component Part of External Wall System)	Reports and other Information	
	Aluminium rainscreen cladding system (Alucobond Plus)	Brick Face
	Build up 1	Build up 2
15mm British Gypsum Gyproc Wallboard plasterboard	Classified without further testing as A2-s1, d0 Commission Decision 96/603/EC, as amended 2000/605/EC	
SFS frame partially filled with class A1 mineral wool	Non-combustible – Deemed to satisfy A1 Commission Decision 96/603/EC as amended 2000/605/EC	
Wraprite SA membrane	Tested and classified as EuroclassE (Website)	
12.0mm Knauf Windliner board	Tested and achieved Euroclass A2-s1,d0, in accordance with BS EN 13501-1:2007	
Celotex RS5000 PIR Foam Insulation	BRE Report 295369 to BS8414-2 Tested to BS 476 Parts 6 and 7 – Class O	
Fixation- Metal brick ties		Non-combustible – deemed to satisfy A1 Class A1 to EN 13501-1
Fixation- Aluminium helping brackets	Non-combustible – deemed to satisfy A1 Class A1 to EN 13501-1	
Cavity Barriers- PFC Corofil C450 and PFC Corofil VFB	Tested in accordance with BS 476:Part 20 & 22:1987, PFC Corofil VFB+ Ventilated Fire Barrier has provided up to 30 minutes and 90 minutes respectively in combustible timber frame and non-combustible constructions	
Brickwork facing		Deemed to satisfy A1 Commission Decision 96/603/EC as amended 2000/605/EC
Aluminium rainscreen cladding system (Alucobond Plus)	Tested and achieved Euroclass B-s1,d0, in accordance with BS EN 13501-1:2007	

VAPOUR CONTROL LAYER 1100 gauge polyethylene

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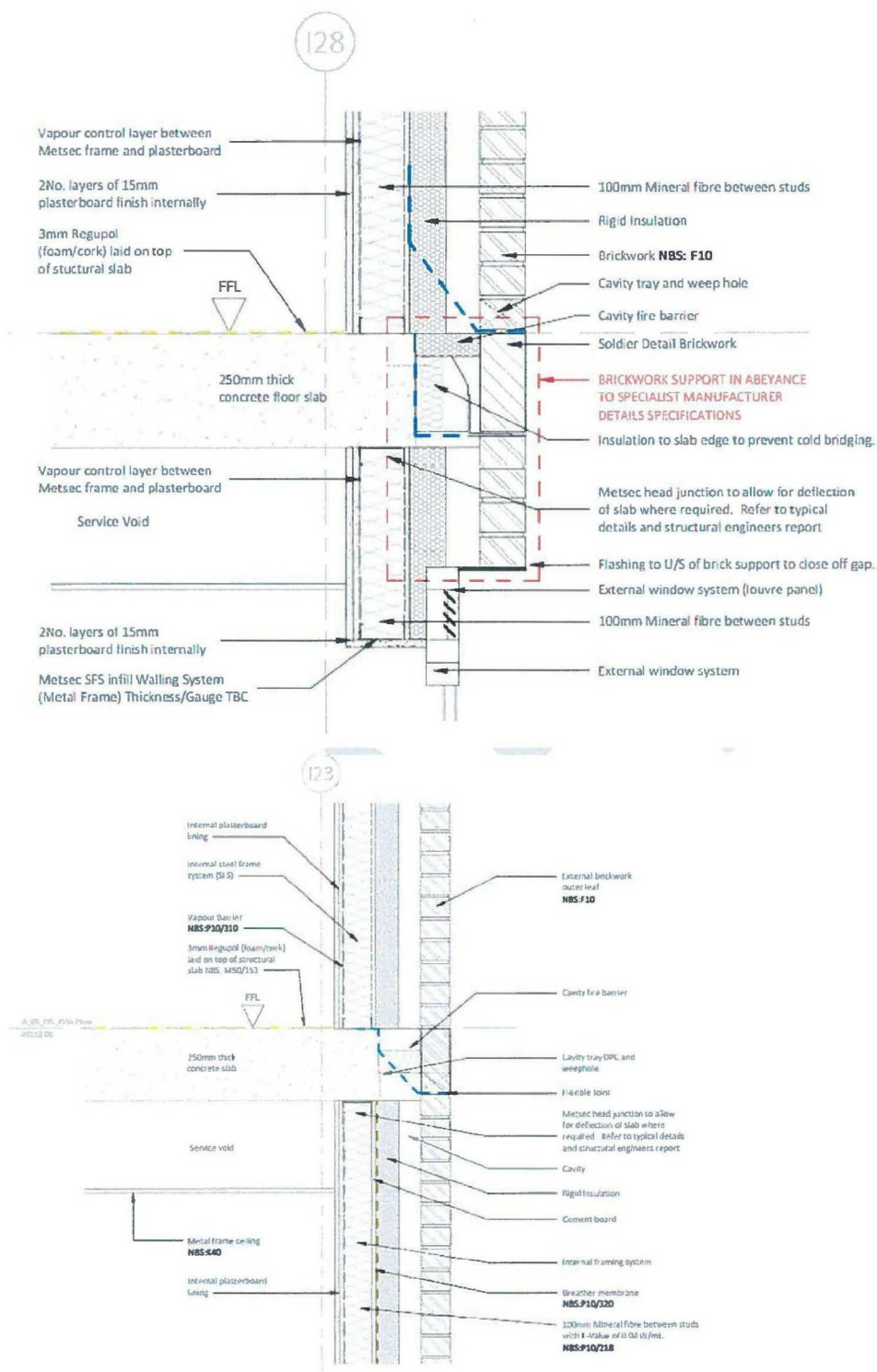
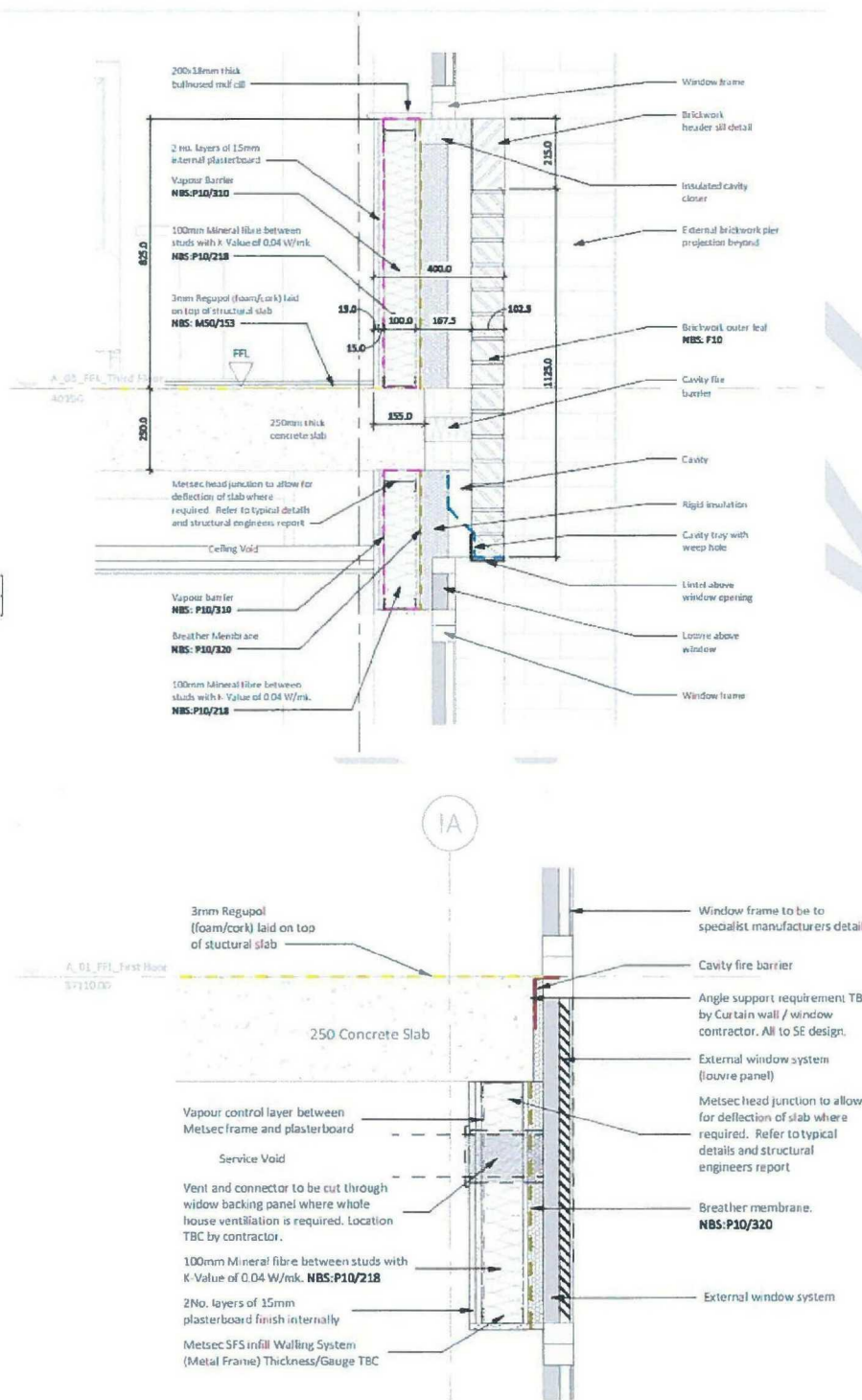


Figure 1 Sample drawing of wall build up and fixings

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Continued Figure 1 Sample drawing of wall build up and fixings

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1. BRE Test Report No 295369

A fire test in accordance with BS8414 - 2 (where the façade system is mounted onto a steel structure rather than a masonry wall) was carried out on a Celotex RS5000 insulated system with a ventilated Eternit Natura fibre cement board facing.

The system consisted of a double layer of 10mm wall board mounted onto a 150mm light steel frame. The sectional steel light frame system (LFS) was installed between the floor slab hangers on the main wall with horizontal base and head trackers fixed to the steel and concrete substrate. On the face of the steel frame was mounted 12mm thick magnesium oxide sheathing board. On this were mounted aluminium L and T rails. A single layer of 150mm Celotex RS5000 insulation board was fixed to the sheathing board with screws and metal washers, the aluminium helping hand brackets protruding through precut slots in the RS5000 board. The construction was faced with 12mm thick Marley Eternit Natura, a fibre cement, decorative rainscreen board. The reaction to fire performance of these boards is A2-s1,d0 to EN 13501-1. In the ventilated cavity, four horizontal fire breaks (Lamatherm CW/RSH) were fixed to the sheathing board and four vertical non- ventilated barriers (Lamatherm CW/RSV) were installed on the outer edges of the cladding and around the fire source hearth.

DESCRIPTION OF THE PROPOSED SYSTEM

The proposed system comprises:

Generic Description	
<p>The alucobond aluminium rainscreen panel system build up 1 comprises:</p> <ul style="list-style-type: none"> • 2 layers of 15mm British Gypsum Gyproc Wallboard plasterboard; • 100mm SFS frame system fully filled with; • 100mm mineral wool; • 12.0mm Knauf Windliner board; • 150mm PIR insulation (Celotex RS5000); • Aluminium helping brackets and rails fixed back to a supporting wall. ; • 48mm- 66mm non ventilated cavity; • At least 80mm PFC Corofil C450 Cavity Firestop as horizontal and PFC Corofil VFB Cavity Firestop as vertical cavity barrier ; • Aluminium rainscreen cladding system (Alucobond Plus) 	<p>The brick work system build up 2 comprises:</p> <ul style="list-style-type: none"> • 2 layers of 15mm British Gypsum Gyproc Wallboard plasterboard; • 100mm SFS frame system fully filled with; • 100mm mineral wool; • 12.0mm Knauf Windliner board; • 85mm PIR insulation (Celotex RS5000); • Fixation, brick ties; • 50 48mm- 66mm non ventilated cavity; • At least 80mm PFC Corofil VFB Cavity Firestop as horizontal and vertical cavity barrier • 102.5mm brick facing.

VAPOUR
CONTROL
LAYER

VAPOUR
CONTROL
LAYER

→ refer to front page wall
build up

refer to front
page for wall build up.

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ASSESSMENT

During the test on the external wall systems in BRE report no 295369, the maximum external air temperature at level 2 remained below the limit of 600°C within 15 minutes of the start time as did the temperature within the cavity between the external finish and the RS5000 the temperature at the mid depth of the insulation. The approximate maximum temperatures at each location within the first 15 minutes of the test are tabulated below:

	BRE Report No 295369 RS5000 (SFS system)
Air Temperature	350°C
Mid Point Cavity Temperature	95°C
Mid Point of Insulation	35°C

This test determines the fire performance of the insulation within the cavity and illustrates which temperatures were recorded at the storey immediately above the fire source. The temperatures within the cavity are dependent on the nature of the fixing detail on the sill above the fire which should be that installed in practice as a window and also on the nature of the facing used.

There are a number of differences between the tested system and the proposed system to be used in the Middlewood Locks project, the most important of which is the use of alucobond aluminium rainscreen panel system and brickwork cladding systems as the facings to the external wall of the system. Other differences can be summarized as follows:

- The internal lining in the test was comprised of a double layer of 12.5 mm Gyproc wallboards which was directly fixed to a SFS frame. In this project, two layers of 15 British Gypsum Gyproc soundbloc with a vapour control layer are proposed. The proposed system is thicker than the tested arrangement and would increase the fire resistance of the arrangement. The vapour control layer is combustible. However, due to low thickness of this layer, it is not expected to generate a considerable level of heat output to change the fire performance of the system. Therefore, it could be expected that the proposed system would have similar performance as that tested.
- With the tested systems there is no insulation in the SFS frame. With the proposed build ups, the frames incorporate Euroclass A1, mineral wool insulation. The additional layer of insulation should slow heat transfer to the wall board and will act as a physical fire barrier which could protect the inner layer in terms of integrity and penetration. Hence, it is expected the proposed arrangement would have similar performance to tested build up.
- With the proposed systems a single layer of 12mm Knauf Windliner board is proposed on the non-cavity side of the insulation. This board replaces the magnesium oxide board used in the test which belongs to a difference category of boards and has a reaction to fire performance of A2 performance. The proposed board system has the same thickness and reaction to fire performance to the board tested. Given that the recorded temperature at level 2 and the middle of cavity is about 95°C, it could be expected that this board would be able to provide sufficient level of support for the insulation connected to it. Thus, it could be expected that under fire condition this board at level 2 would have similar performance as tested.

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- The RS5000 insulation was tested at a thickness of 100mm and will be used in the proposed systems at thickness of 85mm and 150mm. The 150mm of RS5000 would be expected to have similar performance as conducted test since the additional layer of insulation could provide higher level of protection even when it is charred. With 85mm insulation, this change will have a twofold effect. On the one hand, a lower thickness of insulation would lead to a lower level of protection and hence, higher levels of heat transfer to inner side of the cladding and on the other hand a lower thickness means less combustible material. However, the 85mm proposed insulation is shielded with a layer of 102.5mm thick brickwork. Owing to the nature of the brickwork, this will remain in place and provide a substantial level of protection for the insulation located on the cavity side. Therefore, it can be expected that this alteration would not affect the overall fire performance of the cladding.

On the other hand, the RS5000 is a combustible insulation and a lower thickness of this insulation can be interpreted as a smaller amount of combustible material which can add to fire load. Thus, it may be concluded that this change might alter the fire performance of the insulation at level 2 in a positive direction.

- The system in the test conducted with Celotex RS5000 was clad on the exterior with a Marley Eternit Natura fibre cement rainscreen board system. The proposed systems have an aluminium rainscreen cladding or brick facing.

Aluminium rainscreen cladding (Alucobond Plus) has been tested and classified in accordance with EN13502-1 and achieved Euroclass B which satisfy the requirements of Approved document B. This cladding is connected to the substructure by means of aluminium helping hand brackets. Owing to nature of this arrangement, under fire conditions, this cladding may become locally unstable and leave the cavity exposed to direct flame. However, this opening is not expected to be bigger than that formed in the cement rainscreen board system. Thus, in this system, the cavity barriers are crucial to prevent spread of the flame and should they be installed in accordance with the requirements given in ADB, it would be expected that this cladding will satisfy the requirements of BR135

Brick system is a heat treated material and is not expected to be affected by the heat. The brick facing will be expected to remain in place during any fire. We would therefore expect the external temperatures to be no higher than they were in the test conducted on the fibre cement test. In addition, the performance of the cladding in protecting the cavity and the insulation behind should be totally effective and not allow any flame penetration into the cavity and we would therefore expect the cavity and the insulation temperatures to be similar to those in the tested system.

- The cavity barriers in the test conducted to BS8414-2 on systems with cavities were mineral fibre batts fitted to full thickness of the ventilated cavity. The cavity barriers proposed for the vertical barriers are PFC Corofil VFB Cavity Firestop. The horizontal barriers, for the alucobond aluminium rainscreen panel and brick system respectively are the PFC Corofil C450 Cavity Firestop (ventilated system) and PFC Corofil VFB Cavity Firestop (full thickness). The proposed systems should provide the same degree of fire stopping as in the fire resistance test conducted. The entire cavity barriers are proposed in a way that they could give at least 60 minutes fire resistance. Hence if correctly fitted should provide adequate fire stopping in the event of fire entering the cavity.

Note: Cavity barriers should be fitted in accordance with section 9 of Approved Document B, volume 2

Please check cavity barrier types to/against build-up.
- PFC COROFIL C450 (FULL FILL BARRIER.)
- PFC COROFIL VFB. (VENTILATED /INTUMESCENT BARRIER.)

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CONCLUSION

Opinion

It is therefore our opinion that the alucobond aluminium rainscreen panel system and brickwork cladding systems faced Celotex RS5000 system as proposed and as described would satisfy the performance criteria detailed in BR 135 third edition, if tested against BS8414-2:2005.

Validity of opinion

This opinion is based on the requirements of BR 135, third edition and against the requirements of the Building Regulations for England and Wales based on the guidance given in Approved Document B to those regulations.

The opinion has been formulated on the assumption that the information provided by the client was correct and issued by independent third parties and that the client was not aware of any information that could have been provided which may adversely affect the conclusions drawn in the assessment.

This assessment is issued on the basis of test data and information available at the time of issue and provided by Morris Homes Ltd., The assessment is invalidated if the proposed construction is subsequently tested since test data takes precedence over an expressed opinion. Any changes in the proposed system described in this assessment will invalidate this assessment. This assessment relates only to the buildings at Middlewood Locks.

This assessment has been carried out in accordance with the Fire Test Study Group Resolution No 82. It relates to the fire performance of the product and does not cover aspects of quality, durability, maintenance or service requirements. This assessment relates only to the specimen(s) assessed and does not by itself infer that the product is approved under any certification scheme.

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REVISION HISTORY

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Reason for Revision:	

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	

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