Exova Warringtonfire
Holmesfield Road
Warrington
WA1 2DS
United Kingdom

T : [redacted]
F :
E : warrington@exova.com
W: www.exova.com

Testing. Advising. Assuring.

Title:

The External Fire Spread Performance of Façade Cladding Systems for Blackfriars Road in relation to the requirements of BR 135

Report No:

WF No. 370092 Issue 3

Prepared for:

Celotex

Lady Lane Industrial Estate
Hadleigh, Suffolk
IP7 6BA

Date:

4th August 2016

TABLE OF CONTENTS

SECTION **PAGE**

Executive Summary

Objective	This report presents an appraisal of External Fire Spread Performance of Façade Cladding Systems for Blackfriars Road in relation to the requirements of BR 135, based on the expected behaviour when tested following BS 8414 Part 2:2005
Report Sponsor	**Celotex**
Address	Lady Lane Industrial Estate, Hadleigh, Suffolk, IP7 6BA
Summary of Conclusions	It can be concluded that the proposed wall systems with Celotex RS5000- PIR insulation as a component in the external wall insulation, as described in the proposals section of this report, when complying with described conditions, are expected to meet the performance criteria set out in BR 135:2003 for façade systems based on the expected behaviour in the BS 8414 Part 2:2005.
Valid until	31th October 2021

Introduction

This report presents an appraisal of External Fire Spread Performance of the façade constructions in 7 different Wall Types for the project Blackfriars Road in relation to the requirements of BR 135, *Fire performance of external thermal insulation for walls of multi-storey buildings,* based on the expected behaviour when tested following BS 8414 Part 2:2005. The constructions are based on the Celotex RS5000 insulation boards, applied in 7 different wall types:

Wall type 1, Block A1, B1, B2, steel frame wall with external insulation of Celotex RS5000 and brick outer cladding.

Wall type 2, Block A1 and B1, a mullion brick detail, with Celotex RS5000 insulation applied at junctions with concrete floor

Wall type 3, Block A1 West, Block B1, Block B2, Block B3, Block C1, Celotex RS5000 insulation is applied as insulation between a steel frame wall and a brick exterior cladding, and fire breaks applied at floor junctions

Wall type 4, Block B2, steel frame wall with external insulation of Celotex RS5000 and GRC panels, and fire breaks at the floor level.

Wall type 5, Block A1, steel frame wall with external insulation of Celotex RS5000, and combination of brick outer cladding and GRC panels as external facing

Wall type 6, Block B1, a mullion brick detail and GRC panel with Celotex RS5000 insulation applied at junctions with concrete floor

Wall type 7, Block B1, steel frame wall with external insulation of Celotex RS5000, Brick Slipface and GRC panel applied at the floor level

A comparable version of the system has been tested and is described in BRE Report 295369 (of which the essential parts are summarised in BRE report referenced 295255). The system is generally composed of 100 mm Celotex RS5000 boards attached to a magnesium oxide board substrate, and covered with a 12 mm Marley Eternit Natura rainscreen board. The report further describes the fixing details, as well as the application of horizontal and vertical fire breaks.

FTSG

The data referred to in the supporting data section has been considered for the purpose of this appraisal which has been prepared in accordance with the Fire Test Study Group Resolution No. 82: 2001.

Assumptions

Construction details

It is assumed that the construction will be executed within the design constraints as outlined in the test reports, assessments and certificates which are used to assess this construction.

Cavity Barriers

It is assumed that Cavity Barriers and relevant fire stopping will be applied as defined in the Fire Strategy prepared by H+H Fire, 41-42 London Wall, London, EC 2M 5TB; Project ref. UK 01215; 8th November 2016 for 128-150 Blackfriars Road and as per MacCreanor Lavington Details.

Further clarification can be found in the fire break section in the proposals below.

Proposals

General construction

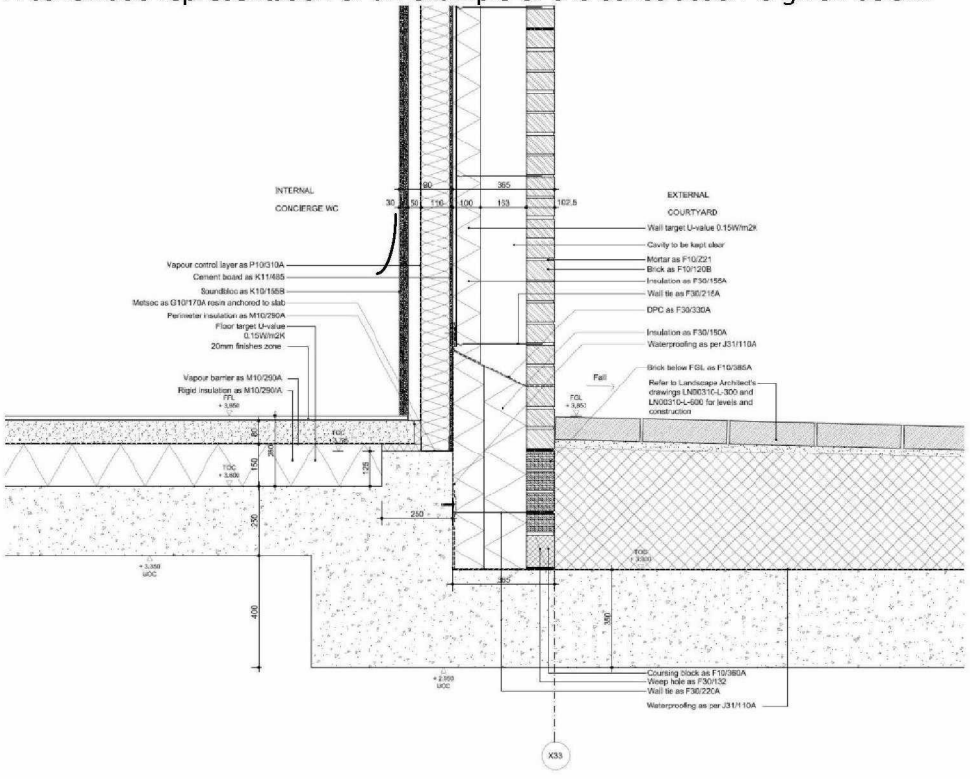
The wall-façade constructions evaluated in this report are schematically described below:

Wall types 1 and 3

Wall types 1 and 3: Steel framing structural wall total thickness 100 mm, interior Soundbloc facing (double layer), 50mm cavity formed by I-stud (sacrificial wall), vapour control layer, 100 mm rock wool internal insulation, and 9mm Y-wall board exterior facing;

100 mm Celotex RS5000 PIR Insulation on the slab edges; 150 mm in front of column faces
Cavity; width varies 50/80/100/163 mm
102 mm brick blockwork exterior façade, fixed onto the structural steelwork with steel wall ties

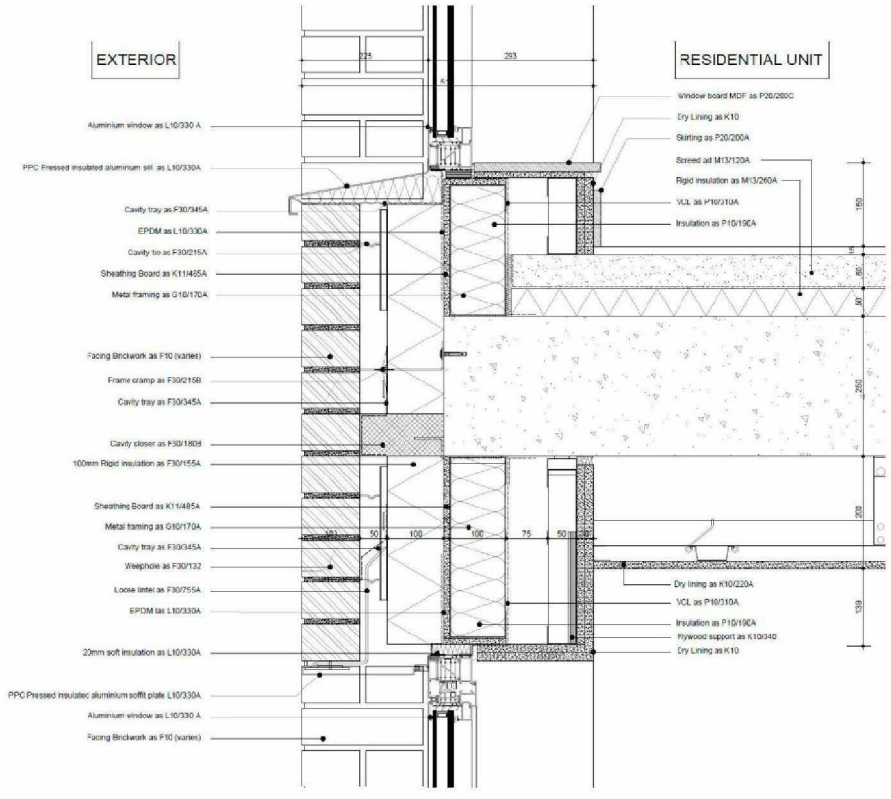
A schematic representation of an example of the construction is given below.



Design: Inside to out, for Brickwork cladding

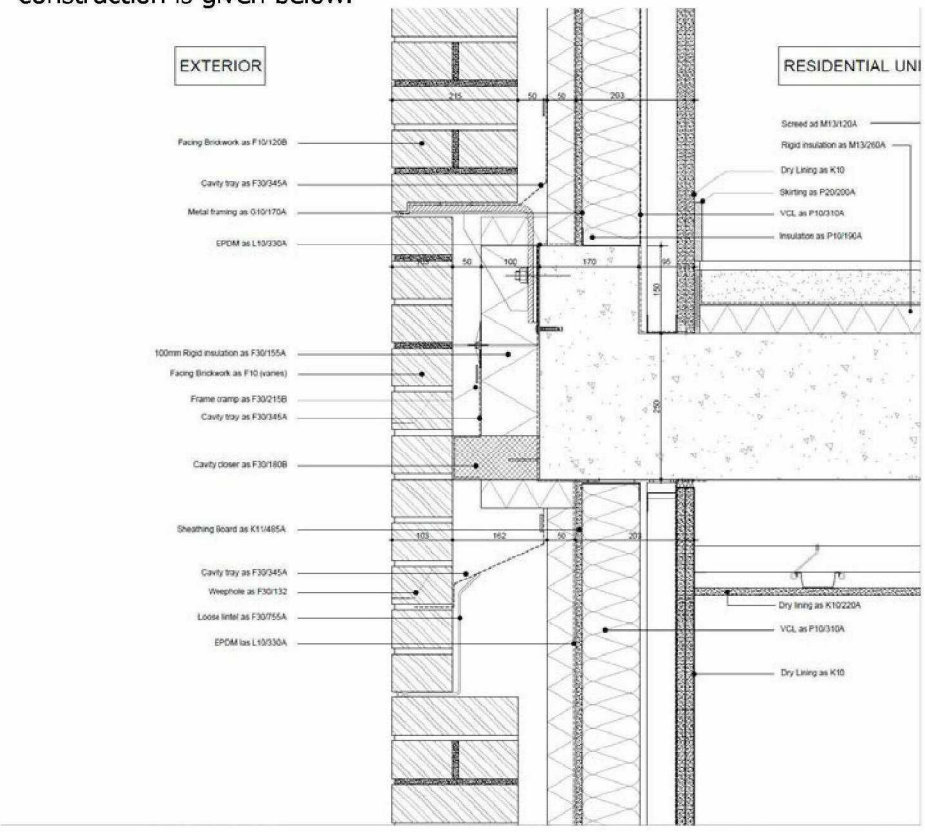
- 2 layers of 15mm thick Gyproc Wallboard plasterboard
- 50mm I-stud (sacrificial wall)
- 100mm Steel framing system
- 100 mm rock wool internal insulation
- 9 mm Calcium Silicate Board – A1
- 100 mm Celotex RS5000
- Un-ventilated Cavity (various widths)
- Outer façade cladding of 102 mm brickwork façade with stainless steel ties.

The schematic drawing below gives an example of the application of Celotex RS5000 insulation material applied at the floor junction, at the head of a window.



Wall type 2

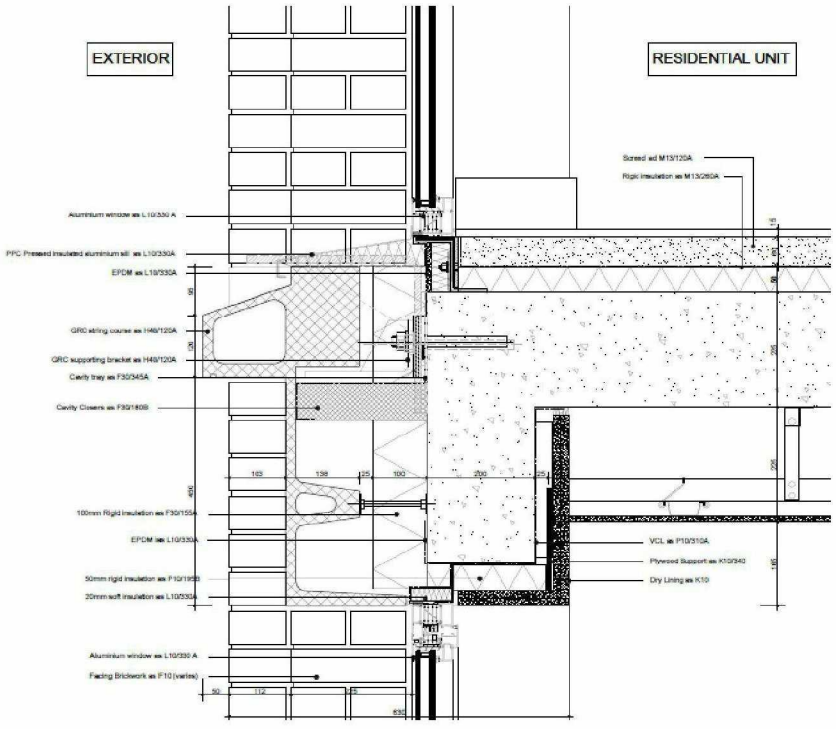
Wall type 2: a double leave brickwork cavity wall, with Celotex RS5000 insulation applied at the floor level; a schematic representation of an example of the construction is given below.



Wall type 4

Wall type 4, Block B2, steel frame wall with external insulation of Celotex RS5000 and GRC panels, and fire breaks at the floor level.

Following figure demonstrates a sample drawing of such arrangement.



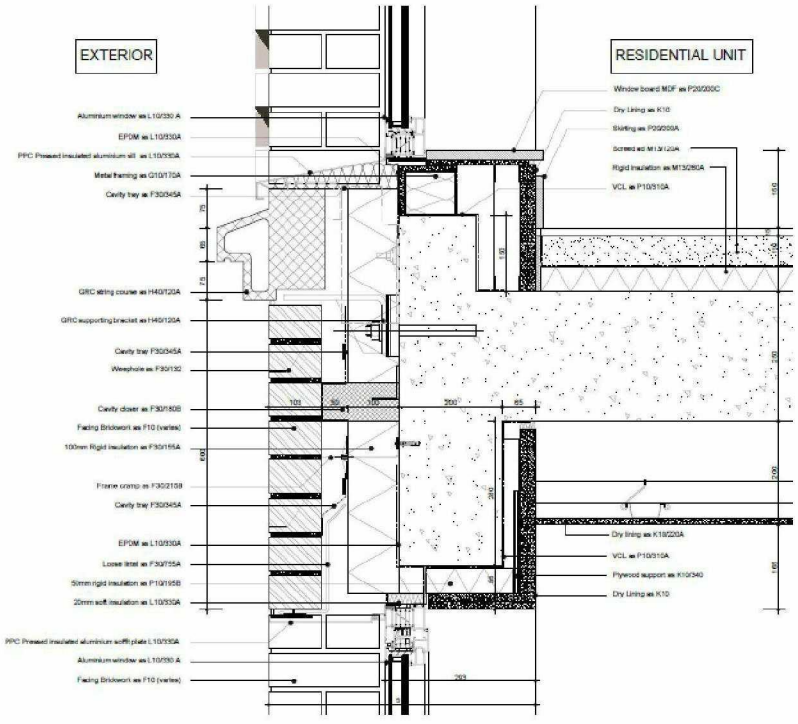
Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum of 15 mm thick, outer Glass Reinforced Concrete (GRC) with aluminium window sill and supporting brackets

Wall type 5

Wall type 5: Comprised of a Brickwork facing and GRC panels filled with Celotex RS5000

The schematic drawing below shows the proposed arrangement using GRC panels and Brickwork facing in which Celotex RS 5000 insulation applied at floor junction.



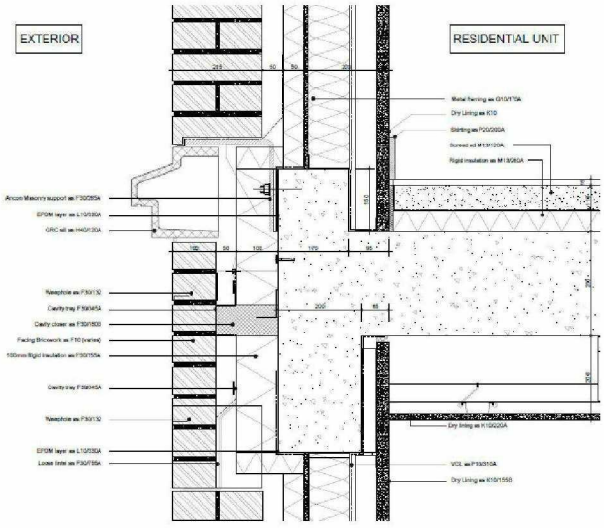
Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum of 15 mm thick, outer Glass Reinforced Concrete (GRC) with aluminium window sill and supporting brackets
- Ancon brackets and brick ties
- 102 mm Facing Brickwork

Wall type 6

Wall type 6: a double leaf brickwork cavity wall with GRC sill, Celotex RS5000 insulation applied at the floor level;

The schematic drawing below shows the proposed arrangement.



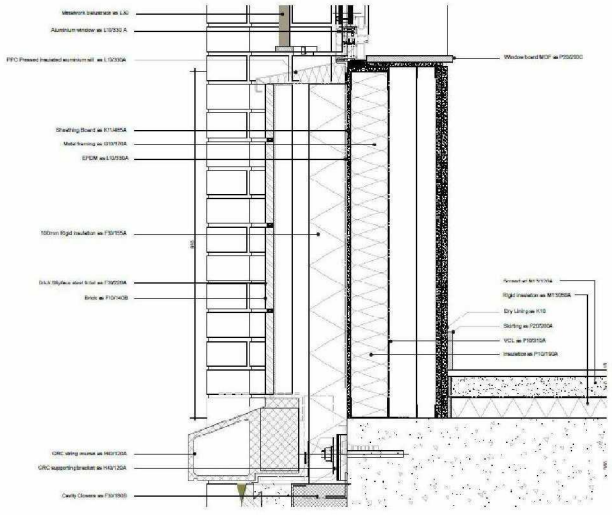
Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum of 15 mm thick, outer Glass Reinforced Concrete (GRC)
- Ancon brackets and brick ties
- 102 mm Facing Brickwork

Wall type 7

Wall type 7: Brick Slipface and GRC Panel, cavity wall, with Celotex RS5000 insulation

Following figure demonstrate a sample drawing of such arrangement.



Design: Inside to out

- 2 layers of 15mm thick Gyproc Wallboard plasterboard
- 60mm I-stud (sacrificial wall)
- 100mm Steel framing system
- 100 mm rock wool internal insulation
- 9 mm Cement based board "RCM Y-wall"
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum of 15 mm thick, outer Glass Reinforced Concrete (GRC)
- Aluminium window sill and supporting brackets
- 25mm thick Brick slipface cladding

Fire breaks

Fire breaks are to be installed as defined in the Fire Strategy prepared by H+H Fire, 41-42 London Wall, London, EC 2M 5TB; Project ref. UK 01215; 8th November 2016 for 128-150 Blackfriars Road and as per MacCreanor Lavington Details.

Cavity barriers and compartment closers should be as per the Maccreannor Lavington details, where the cavity closers on the jambs run continuously from floor to floor to meet the horizontal compartment closers and provide a continuous fire separation to the window opening as per Maccreannor Lavington detail numbers MLUK-320-A1-200 to 501. The horizontal and vertical compartment closers provide a continuous separation for each unit.

Basic Test Evidence

BRE Test report 295369

The BRE Test report 295369 (of which the essential parts are summarised in BRE report referenced 295255) describes the fire performance of the Celotex façade cladding system when tested to BS 8414: Part 2:2005.

The test specimen was constructed as follows:

Metal frame, cladded with 12 mm Magnesium Oxide board

100 mm Celotex RS5000 PIR insulation

140 mm "helping hand" brackets

60x40x2 mm continuous aluminium rail

12 mm Marley Eternit Natura cladding panel

Leaving a 40 mm ventilated cavity between insulation and cladding

Lamatherm CW-RHS Horizontal intumescing Fire Breaks (Cavity Barriers) were fixed onto the Magnesium Oxide Boards in four positions, at distances of 2.50 m; Lamatherm CW-RSV Vertical Fire Breaks (Cavity Barriers) were applied around the combustion chamber and at the outer edges of the test specimen. The application of fire breaks is as required to meet the appropriate Building Regulation requirements.

After ignition of the crib the test lasted for 60 minutes, when all flaming had ceased. The insulation layer kept burning after the crib had extinguished. Damage to the insulation layer extended to about ¾ of the specimen, the insulation was severely charred, and damage extended beyond the position of the first horizontal fire breaks. Temperatures measured were within the limits specified in the BR 135, so it can be concluded that the tested construction meets the performance criteria set in BR 135.

The test was carried out on the 2nd May 2014

Assessed Performance

Exterior wall face

The exterior face of the structural steel wall, onto which the insulation is attached, consisted of 12 mm magnesium oxide boards in the test referenced 295369. In the constructions discussed in this report, the facing for all wall types is proposed to be 9 mm RCM Y-wall boards. In terms of fire properties and general physical properties the two types of board are very similar. It is therefore expected that the general behaviour of the construction, when tested in accordance with BS8414-2, will not be significantly influenced by this change in wall facing.

The RCM Y-wall boards are calcium silicate based fibre cement boards, with a non-combustible rating (A1 in accordance with EN 13501-1) and a good performance as boards in fire resistance constructions (tested in accordance with BS 476 part 21 or BS 476 part 22). The nominal density of Y-wall boards is 1200 kg/m^3, higher than the nominal density of 1050 kg/m^3 for magnesium oxide boards. This could possibly result in a higher thermal capacity, reducing the temperatures in the boards and the cavity behind it, but considering the actual temperatures measured during the test it is not expected that this change will result in any noticeable change of the test results.

It can therefore be concluded that the change of 12 mm magnesium oxide boards for 9 mm RCM Y-wall boards will not result in a significant change in test results when the constructions are tested in accordance with the BS 8414-2

Assuming that the overall stability and rigidity of the wall remains at least equal that of the tested wall, further changes to the interior side of the wall compared to the tested construction will have a minimal influence on the results if the construction were to be tested in accordance with BS 8414-2. Observation and measured temperatures on this part of the test specimen indicated that this part of the construction was not significantly effected by the test conditions.

Wall type 1 and 3

Wall types 1 and 3 are generally constructed, inside to out, as follows:

Steel framing structural wall total thickness 100 mm, interior Soundbloc facing, 50mm cavity formed by I-stud, vapour control layer, 100 mm rock wool internal insulation, and RCM Y-wall board exterior facing;

100 mm Celotex RS5000 PIR Insulation on the exterior of the slab edges; 150 mm on the exterior of the column faces
Cavity; width varies 50/80/100/163 mm
102 mm brick blockwork exterior façade, fixed onto the structural steelwork with steel wall ties

Fire breaks (cavity barriers) will be applied as described in the referred Fire Strategy prepared by H+H Fire.

Cavity barriers and compartment closers should be as per Maccreannor Lavington details, where the cavity closers on the jambs run continuously from floor to floor to meet the horizontal compartment closers and provide a continuous fire separation to the window opening as per Maccreannor Lavington detail numbers MLUK-320-A1-200 to 501. The horizontal and vertical compartment closers provide a continuous separation for each unit.

Wall types 4,5 and 6

Wall type 4 consist GRC panel at the front of the façade in the floor level.

Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum 15 mm thick, outer Glass Reinforced Concrete (GRC) with aluminium window sill and supporting brackets

Wall type 5: Comprised of a Brickwork facing and GRC panels filled with Celotex RS5000.

Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum 15mm thick, outer Glass Reinforced Concrete (GRC) with aluminium window sill and supporting brackets
- Ancon brackets and brick ties
- 102 mm Facing Brickwork

Wall type 6: a double leaf brickwork cavity wall with GRC sill, Celotex RS5000 insulation applied at the floor level.

Design: Inside to out

- 170/200 mm concrete slab
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum 15 mm thick, outer Glass Reinforced Concrete (GRC)
- Ancon brackets and brick ties
- 102 mm Facing Brickwork

Fire breaks (cavity barriers) will be applied as described in the referred Fire Strategy prepared by H+H Fire.

Cavity barriers and compartment closers should be as per Maccreannor Lavington details, where the cavity closers on the jambs run continuously from floor to floor to meet the horizontal compartment closers and provide a continuous fire separation to the window opening as per Maccreannor Lavington detail numbers MLUK-320-A1-200 to 501. The horizontal and vertical compartment closers provide a continuous separation for each unit.

Wall type 7

Wall type 7: Brick Slip face and GRC Panel, cavity wall, with Celotex RS5000 insulation;

Design: Inside to out

- 2 layers of 15mm thick Gyproc Wallboard plasterboard
- 60mm I-stud (sacrificial wall)
- 100 mm rock wool internal insulation
- 100mm Steel framing system
- 9 mm Cement based board "RCM Y-wall"
- 100mm Celotex RS5000 PIR Insulation
- Unventilated Cavity Fire Barrier
- GRC supporting bracket fixed to the concrete slab;
- Minimum 15 mm thick, outer Glass Reinforced Concrete (GCR)
- Aluminium window sill and supporting brackets
- 25mm thick Brick slip cladding

Fire breaks (cavity barriers) will be applied as described in the referred Fire Strategy prepared by H+H Fire.

Cavity barriers and compartment closers should be as per Maccreannor Lavington details, where the cavity closers on the jambs run continuously from floor to floor to meet the horizontal compartment closers and provide a continuous fire separation to the window opening as per Maccreannor Lavington detail numbers MLUK-320-A1-200 to 501. The horizontal and vertical compartment closers provide a continuous separation for each unit.

External flame spread

The 12 mm Eternit Natura fibre cement board from the test is replaced by a 102 mm brickwork façade, 25mm brick slip face made of clay fired brick and 15 mm GRC panels, which are constructed from non-combustible (as defined in Section 8 of Appendix A of Approved Document B (2006) materials.

Given that the Brickwork (wall type 1,2,3) has a thicker construction of higher density, the flame spread over such a brickwork surface is expected to be at least as good as that over the tested fibre cement board surface. So it can be concluded that if the alternative construction 1 would be tested in accordance with BS 8414-2 the external flame spread results would still be meeting the requirements defined in BR 135.

The system in the test conducted was clad on the exterior with cement particle board system. However, with the wall types 4, 5 and 6, the proposed system has a 15 mm glass reinforced cement (GRC) board rainscreen cladding. This is a non combustible board which is bound with the glass fibres to give additional structural strength. The flame spread over such a GRC surface is expected to be at least as good as that over the tested fibre cement board surface, so it can be concluded that if the alternative construction 4 were to be tested in accordance with BS 8414-2 the external flame spread results would still meet the requirements defined in BR 135.

Wall types 5 and 6 are comprised of combination of a brickwork facing and GRC panels. These combinations are expected to have similar performance on external façade as wall type 4.

In case of a fire, Celotex RS5000 insulation is protected by either a brick or GRC panels, which have a greater thickness and could therefore provide a higher level of protection than the Eternit Natura fibre cement. Therefore it is expected that the Celotex insulation located behind the surface of the brickwork or GRC panels would perform in a similar fashion to that which was tested.

Eternit Natura Fibre cement board from the test is replaced by a brick slip façade (Wall type 7), which is fabricated from fire clay brick and is therefore deemed to be non-combustible (as defined in Section 8 of Appendix A of Approved Document B (2006) materials. The thickness of the brick slips is greater than the Marley Eternit Natura cladding panels which have been tested. The brick slips also have a higher density and therefore have a greater heat sink effect. Therefore the flame spread over such a brickwork surface is expected to be at least as good as that over the tested fibre cement board surface.

Internal fire spread

Compared to the tested construction, the internal insulation material is better protected from the external fire by the brickwork, the brick slip cladding and the GRC panels. In the alternative design the effect of the external fire spread on the internal insulation will consequently be similar to the tested construction.

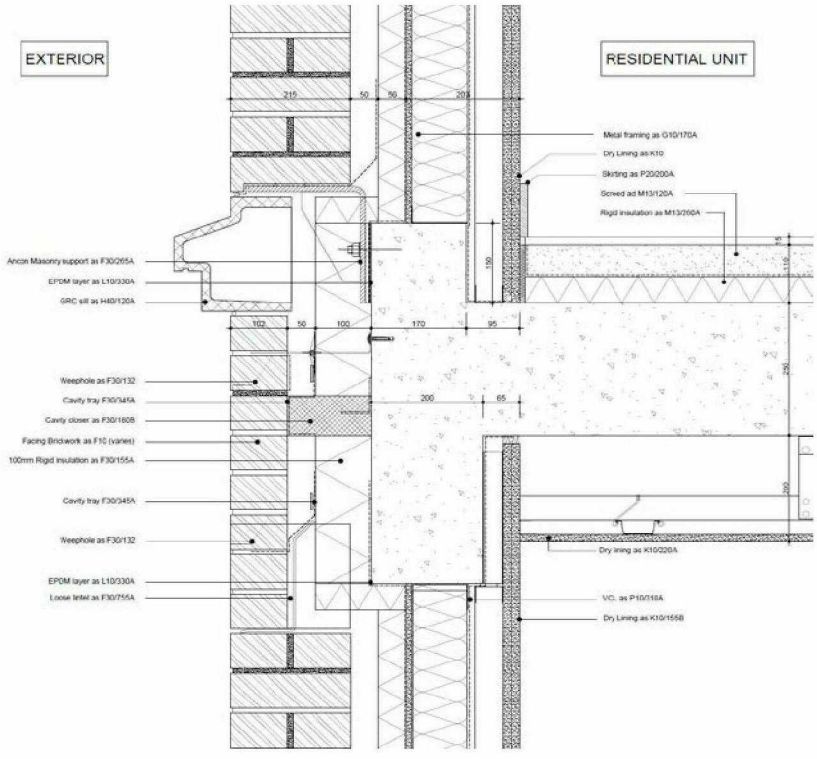
Compared to the tested construction, the internal insulation material sits behind brickwork construction, which will act as a heat sink. It is therefore expected that the internal burning of the insulation material will be less severe than in the tested construction, and that the internal flame spread and temperatures will not exceed those in the tested construction.

Expected performance

Based on the considerations outlined above, it is expected that the design with an external brickwork façade cladding, brick slip cladding and GRC panels, when tested in accordance with BS 8414-2, will meet the performance requirements as outlined in BR 135

Floor junction insulation

In some locations the Celotex RS5000 insulation is applied at the junction of floor slabs with walls. In this application the insulation does not form a continuous layer of material over the exterior of the building, but is applied in localised positions; flame spread through a (semi-continuous) cavity is not a consideration for this application. A schematic example is given below.



In this application the insulation material does not form a continuous cavity, it sits behind a cladding as discussed above, and cavity barriers are applied to prevent any fire spread. This application is therefore not considered to be a concern in relation to fire spread as discussed in Section B4, Section 12, Construction of External Walls, 12.5 – 12.9

Conclusions

It can be concluded that the façade constructions in 7 different Wall Types for the project Blackfriars Road with Celotex RS5000 PIR insulation in the façade construction are expected to meet the performance criteria set out in BR 135 for façade systems based on the expected behaviour in the BS 8414 Part 2

It can therefore be assumed that the façade constructions in 7 different Wall Types for the project Blackfriars Road with Celotex RS5000 PIR insulation in the façade construction, as described in the body of this report, and with the use of the relevant cavity barriers and fire stopping as defined in the Fire Strategy prepared by H+H Fire, meet the requirements for external walls as outlined in section 12.5 of Approved Document B, *External Wall Construction*.

Validity

This assessment is issued on the basis of test data and information available at the time of issue. If contradictory evidence becomes available to Exova Warringtonfire the assessment will be unconditionally withdrawn and Celotex Insulation Ltd will be notified in writing. Similarly, the assessment is invalidated if the assessed construction is subsequently tested because actual test data is deemed to take precedence over an expressed opinion.

The appraisal is only valid provided that no other modifications are made to the tested construction other than those described in this report.

Declaration by Celotex

We the undersigned confirm that we have read and complied with the obligations placed on us by the UK Fire Test Study Group Resolution No. 82: 2001.

We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the Standard against which the assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to cease using the assessment and ask Exova Warringtonfire to withdraw the assessment.

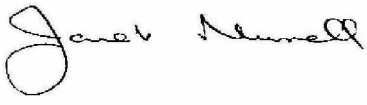
Signed:

For and on behalf of:

Signatories

Responsible Officer

M. Jafarian* - Certification Engineer



Approved

J Murrell* - Technical Manager

* For and on behalf of Exova Warringtonfire.

Report Issued: 4th August 2016

The assessment report is not valid unless it incorporates the declaration duly signed by the applicant.

Revision History

Issue No: 2	Issue Date: 10th August 2016
Revised By: Frans Paap	Approved By: J. Murrell
Reason for Revision: This document replaces Issue 1 (dated 4th August 2016) of the same number which has now been withdrawn. Amendments have been made to reflect changes in the design details at the request of the sponsor.	

Issue No : 3	Issue Date: 15th November 2016
Revised By: Wioleta Kubicka	Approved By: J. Murrell
Reason for Revision: This document replaces Issue 2 (dated 10th August 2016) of the same number which has now been withdrawn. Additional information has been included throughout the assessment at the request of the sponsor.	