



Penhill and Leabank, Luton

External Wall Construction

Fire Engineering Assessment

Revision 07

6 April 2020

Summary

Introduction

Penhill and Leabank are existing, high-rise residential buildings in Luton that are to be retrospectively fitted with an external wall insulation. In light of recent events at Grenfell, Design Fire Consultants (DFC) has been appointed by the client to conduct an independent review of the proposed over cladding, the purpose of which it to:

1. Ensure compliance with Part B of Schedule 1 to the Building Regulations 2010 (including 2018 amendments).
2. Provide advice on any fire safety improvements that could be made to the proposed system.

The assessment comprises a desktop review of the proposed works against the recommendations of relevant guidance document and standards. It includes a review of the proposed insulation and cladding products and associated data sheets and/or fire testing reports.

Legislative Compliance

The addition of external wall insulation is considered building works, and is controllable under the Building Regulations. Therefore, it must achieve the minimum standard required by Part B of Schedule 1 to the Building Regulations 2010¹ (Part B).

Approved Document B² (ADB) has been used as the basis of assessment for compliance with Part B.

In addition the works must comply with Regulation 7(2) of the Building Regulations.

Assessment

There are three wall types being proposed; render, brick slips and the AKV system. DFC has reviewed all systems for compliance with ADB and Part B and concluded that the proposed designs of the three system achieve an adequate standard for compliance with Part B.

This requires that the following be confirmed:

- Appropriate test certificates must be provided for the selected cavity barrier systems.
- Openings in external wall constructions need to be adequately closed.

In DFC's opinion, the render construction complies with Regulation 7(2) because it is a permitted exemption under Regulation 7(3), the brick slips comply with Regulation 7(2) because all materials achieve Euroclass A2-s1, d0 and the AKV system complies with Regulation 7(2) because all materials achieve Euroclass A2-s1, d0.

Risk Reduction

Risk reduction is not necessary for compliance with Part B, but fire risk could be reduced by any of the following.

- Ensure that the render system complies with the recommendations of BR 135.
- Using a brick slip system that achieves Euroclass A2 or that has been shown to meet the BR 135 acceptance criteria through testing in accordance with BS 8414.

¹ Statutory Instruments, '2011 No. 1515 Building and Buildings, England and Wales, The Building (Amendment) Regulations 2011', 2.1515 (2011), 1-4

² HM Government, The Building Regulations 2010, Approved Document B (Fire Safety), Volume 2 – Building other than dwelling houses, 2006 edition incorporating 2007, 2010 and 2013 amendment

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1 Introduction

1.1 Review Purpose and Scope

Penhill and Leabank are existing, high-rise residential buildings in Luton that are to be retrospectively fitted with an external wall insulation. There are two main systems proposed; brick slips and an aluminium rain screen cladding over non-combustible insulation.

In light of recent events at Grenfell, Design Fire Consultants (DFC) has been appointed by the client to conduct an independent review of the proposed over cladding, the purpose of which is to:

1. Ensure compliance with Part B of Schedule 1 to the Building Regulations 2010.
2. Provide advice on any fire safety improvements that could be made to the proposed system.

The assessment comprises a desktop review of the proposed works against the recommendations of relevant guidance document and standards. It includes a review of the proposed insulation and cladding products and associated data sheets and/or fire testing reports.

It remains the responsibility of the designers to develop adequate designs in accordance with manufacturer details and test limitations of the contractor to ensure that the systems and components are fixed and fitted in accordance with the design and manufacturers details.

1.2 Fire Legislation and Codes and Standards

The addition of external wall insulation is considered building works, and is controllable under the Building Regulations. Therefore, it must achieve the minimum standard required by Part B of Schedule 1 to the Building Regulations 2010³ (Part B). In addition, the materials used must comply with Regulation 7(2) of the Building Regulations.

Approved Document B⁴ (ADB) has been used as the basis of assessment for compliance with Part B.

1.3 Building Description

The important features of the buildings (as defined in ADB) from a fire perspective are:

- Purpose group: 1(a) Flat.
- Evacuation strategy: defend-in-place (aka stay-put).
- Height of top storey: 35m approximately.
- Building height: 38m approximately.
- Minimum distance any part of an external wall to nearest boundary: more than 3m.

1.4 Terminology

For the purposes of this report the following terminology is used (see Appendix D for details):

- Non-combustible is a product that achieves Euroclass A1 or has been tested as such in accordance with BS 476-4 or BS 476-11, or is a material listed in Table A6 of ADB.

³ Statutory Instruments, '2011 No. 1515 Building and Buildings, England and Wales, The Building (Amendment) Regulations 2011', 2.1515 (2011), 1–4

⁴ HM Government, The Building Regulations 2010, Approved Document B (Fire Safety), Volume 2 – Building other than dwelling houses, 2006 edition incorporating 2007, 2010 and 2013 amendment

- Limited combustibility is a product that achieves Euroclass A2 or has been tested as such in accordance with BS 476-11, or any material listed in Table A7 of Approved Document B.
- Combustible is a product that is not either non-combustible or of limited combustibility. Products that achieve national class 0 or Euroclass B are combustible unless they also meet the criteria in either of the above bullet points.
- A product that is Euroclass A1/non-combustible also achieves Euroclass A2/limited combustibility.
- A product that is Euroclass A2/limited combustibility also achieves Euroclass B/National Class 0.
- Euroclass B is equivalent to national class 0.
- A product that is national class 0 is not necessarily equivalent to Euroclass B.

1.5 Non-legislative Considerations

DFC has been appointed to assess adequacy for compliance with the Regulatory Reform (Fire Safety) Order. The scope of this legislation is limited to health and safety of people in and around completed buildings. As such, DFC's scope and the content of this report are limited to health and safety of people in and around the building. This includes occupants of the building, occupants of adjacent buildings and access and facilities for the fire service to assist them in the protection of building occupants.

Therefore, this report does not consider:

- Commercial risk: Where buildings have been found to contain combustible insulation and/or combustible cladding, it is possible that the value of those buildings has decreased. This could be as an asset as a whole or for individual flats.
- Reputational risk: If there were to be a fire over the external wall construction of a building that has been found to contain combustible insulation and/or cladding, there might be reputational consequences for the building owners or managers, regardless of whether and adequate standard of health and safety was achieved.

Therefore, there might be commercial or reputational reasons to provide mitigation in addition to minimum required for health and safety.

2 External Wall Constructions

2.1 Location

The rendered system is located in strips at low level around the base of the building to eliminate cold bridging.

2.2 Wall Type 1: Rockwool Duoslab System

The primary components of Wall Type 1 are summarised in Table 1.

	As-built System	Combustibility
Inner layers	Blockwork	Non-combustible
	Brickwork	Non-combustible
Insulation	Rockwool Duoslab	Non-combustible
Cladding	Aluminium	Non-combustible*

Table 1: External wall build-up for Wall Type 1

* The coating on the aluminium is between 60 -80 microns (which is a thin coating). Generally a surface coating of greater than 100 microns (0.1mm) will not always achieve A2 rating. This is only to inform you as the client that although the material is tested to A2, the manufacturing process needs to be carefully controlled to ensure the surface coatings are maintained at the tested thickness especially at joints and cutting lines where the coatings can exceed more than 200 microns.

There are no openings in the system.

2.3 Wall Type 2: Brick Slip

2.3.1 Location

Ground and First Floor will be overclad using the Fast Clad brick slip system in combination with Rockwool insulation.

2.3.2 Build-up

The primary components of Wall Type 2 are summarised in Table 2.

	As-built System	Combustibility
Inner layers	Blockwork	Non-combustible
	Brickwork	Non-combustible
Insulation	80mm Rockwool mineral wool or similar	Non-combustible
Cladding	Permarock Brick Cladding System	Class A2-s1, d0

Table 2: External wall build-up for Wall Type 2

2.3.3 Cavity Barriers

Horizontal and Vertical

There is no cavity within Wall Type 2, and therefore, cavity barriers are not required.

Openings

There is no cavity within Wall Type 2, and therefore, protection for any openings within Wall Type 2 (e.g. windows and pipes) is not required.

2.4 Wall Type 3: AKV Cladding System

2.4.1 Location

Second Floor to the top of the building (including the parapet) will be overclad using the Genius system that comprises a non-combustible aluminium rain screen cladding over non-combustible insulation.

2.4.2 Build-up

The primary components of Wall Type 3 are summarised in Table 2.

	As-built System	Combustibility
Inner layers	Blockwork	Non-combustible
	Brickwork	Non-combustible
Insulation	75mm Rockwool mineral wool or similar	Non-combustible
Cavity	Support Frame	Non-combustible
Cladding	Aluminium Cladding Panel	Surface: National class 0 System: Non-combustible

Table 3: External wall build-up for Wall Type 3

2.4.3 Cavity Barriers

Horizontal

FIREZERO/45/RS/VENT horizontal cavity barriers are provided at each floor level. These are 'open state' cavity barriers comprising a non-combustible, high density mineral wool with non-combustible graphite intumescent facing strip. Open state barriers leave a gap through which cavities can be ventilated and that have an intumescent that activates at high temperature to close the gap(s) in the event of a fire.

The data sheet that has been provided is for the 1030 series and states that the barriers have a fire resistance of between 30 minutes and 240 minutes. However, the data sheet does not state the test standard to which the barriers have been tested. Furthermore, the 1030 series does not appear to be listed on the MDL Insulations website.

Test certificates or test reports should be provided by the contractor for the selected product such that the stated performance can be verified.

Vertical

FIREZERO MULTI APPS SLAB vertical cavity barriers are provided in locations where internal compartment walls meet the external wall construction. These are 'closed state' cavity barriers comprising a non-combustible mineral wool faced with aluminium foil. Closed state barriers close the cavity without any gaps.

The data sheet that has been provided is for the 7280 series and states that the barriers have a fire resistance of between 30 minutes and 180 minutes. However, the data sheet does not state the test standard to which the barriers have been tested. Furthermore, the 7280 series does not appear to be listed on the MDL Insulations website.

Test certification must be provided for the selected product.

Openings

Any openings within Wall Type 3 will be protected by cavity barriers achieving a fire resistance standard of 30 minutes (integrity and insulation).

3 Compliance Assessment

3.1 Legislative Requirements

On completion, the external wall construction is required to comply with Part B of the Building Regulations (see Appendix A for requirements). Specifically, the external wall construction is required to achieve an adequate standard for compliance with Parts B3(3), B3(4) and B4(1).

3.2 Assessment

The ADB recommendations that are relevant to external wall construction are provided in Appendix B. DFC has reviewed the proposed external wall constructions (as detailed in Section 2) against these recommendations, and the findings are summarised below.

Whilst compliance with ADB tends towards demonstrating compliance with Part B, it is not mandatory to comply with ADB. Where the design does not comply directly with ADB, DFC has conducted a qualitative risk assessment to determine compliance with the intent of ADB or compliance with Part B directly. These assessments are included in the descriptions of each wall type assessment below.

3.2.1 Wall Type 1: Rockwool Duoslab System

Compartmentation

The Rockwool insulation located above the strips of polystyrene achieves the standard required for fire stopping. Therefore, it can be concluded that adequate horizontal cavity barriers are being provided.

The system is located below the line of the Ground Floor; therefore, there are no compartment walls meeting this form of external wall construction and vertical cavity barriers are not required to maintain compartmentation.

There are no openings within the render external wall construction.

Therefore, the external wall construction complies with ADB in terms of compartmentation.

Flame Spread

The external surface of the external wall construction (render) is national class 0 and Euroclass A1. Therefore, the external wall construction complies with ADB in terms of flame spread.

Combustibility

The system and its components are non-combustible.

Therefore, the wall construction complies with ADB.

Space Separation

The area of the polystyrene is such that does not present a risk of fire spread to adjacent buildings. Therefore, the external wall construction complies with Part B in terms of space separation.

Regulation 7(2)

The system achieves Euroclass A2-s1, d0 or better. Therefore, the construction complies with Regulation 7(2) of the Building Regulations.

3.2.2 Wall Type 2: Brick Slips

Compartmentation

The Rockwool insulation is non-combustible and achieves the standard required for fire stopping. There is no cavity in the proposed system. Therefore, the system complies with ADB recommendations in respect of compartmentation.

Flame Spread

The external surface of the external wall construction (resin brick) is national class 0 and Euroclass A2-s1, d0. Therefore, the external wall construction complies with ADB in terms of flame spread.

Additionally, all other external wall surfaces (Wall Type 3 and concrete) are national class 0, and therefore, the risk of flame spread from one system to another is acceptably low.

Combustibility

The brick slips (resin) and system components are Class A2-s1, d0 or Class A1.

Therefore, the wall construction complies with ADB.

Space Separation

The widest flat is approximately 10m wide, and each flat is approximately 3m high. These flats have three windows that have a total area of approximately 4.6m². ADB recommends that half the area of any wall containing combustible materials be added to the unprotected area giving a total unprotected area of 17.3m² (i.e. approximately 60%). Using Table A of BR 187⁵, the minimum separation distance between any elevation and the relevant boundary should be 3m. The relevant boundary is either the site boundary or the centreline of any public way.

The relevant boundary is more than 3m for all elevations of both buildings. Therefore, the external wall construction complies with ADB in respect of space separation.

Regulation 7(2)

The system achieves Euroclass A2-s1, d0 or better. Therefore, the construction complies with Regulation 7(2) of the Building Regulations.

3.2.3 Wall Type 3: AKV Cladding System

Compartmentation

The stated performance of the vertical cavity barriers meets ADB recommendations in terms of compartmentation.

The horizontal cavity barriers do not meet ADB recommendations because they are open state cavity barriers and as such could not pass the first few minutes of a BS 476-22⁶ fire test.

The purpose of cavity barriers is to ensure that any hidden voids in the construction are sealed and sub-divided to inhibit the unseen spread of fire and products of combustion, in order to reduce the risk of structural failure and the spread of fire, in so far as they pose a threat to the safety of people in and around the building. The likelihood of fire spread beyond the cavity barrier is low because there are no combustible materials within the cavity and the barrier will activate as the temperature increases. Furthermore, a fire that is large enough to cause fire spread beyond the cavity barrier will also be large enough to activate the cavity barrier. It is possible that 'cold' smoke could spread beyond the cavity

⁵ R. Chitty, 'External Fire Spread – Building separation and boundary distances' (BR 187), Second Edition, 2014

⁶ BS 476: Part 22, 'Fire tests on building materials and structures. Method for determination of fire resistance of non-loadbearing elements of construction', 1987

barrier before it activates, the hazard caused by cold smoke is low because cold smoke is not hazardous, and it cannot break into building as the cavity is sealed by the inner layers of the external wall and the protection around openings (see below).

Therefore, whilst the proposed system does not comply with ADB recommendations in terms of compartmentation, it achieves the intent of ADB and an adequate standard for compliance with Part B.

Flame Spread

The external surface of the external wall construction (aluminium) is national class 0 and Euroclass A1. Therefore, the external wall construction complies with ADB in terms of flame spread.

Additionally, all other external wall surfaces (Wall Type 2 and concrete) are national class 0, and therefore, the risk of flame spread from one system to another is acceptably low.

Combustibility

All materials within the external wall construction are non-combustible. Therefore, the system exceeds ADB recommendations in respect of combustibility.

Space Separation

The external wall construction does not include combustible components, and therefore, does not need to be included in the unprotected area for the purposes of space separation assessments.

Regulation 7(2)

The system complies with Regulation 7(2) because materials which are to become part of the external wall are of Euroclass A2-s1, d0 or A1, classified in accordance with BS EN 13501- 1:2007+A1:2009 entitled "Fire classification of construction products and building elements. Classification using test data from reaction to fire tests" (ISBN 978 0 580 59861 6) published by the British Standards Institution on 30th March 2007 and amended in November 2009.

3.3 Opinion on Compliance

Based on the assessment in Section 3.2, it is DFC's opinion that:

- All three external wall constructions achieve an adequate standard for compliance with Part B.
- All three external wall constructions comply with Regulation 7(2) because all new materials are Euroclass A2-s1, d0 or better.

3.4 Existing Fire Risk Assessments

DFC has reviewed the Fire Risk Assessments for Penhill⁷ and Leabank⁸. These assessments do not make any assumptions regarding the performance of the external wall construction, and therefore, the proposed works do not require any changes to the assessments.

Once the works are completed, DFC recommends that the risk assessments be updated to acknowledge the external wall constructions such that any changes to the external wall construction through life building can be picked up and addressed in future risk assessments.

⁷ Stuart Hood, 'Fire Risk Assessment: 11-148 Penhill', Building Reference 534201, 16 June 2017

⁸ Stuart Hood, 'Fire Risk Assessment: 11-148 Lea Bank', Building Reference 413201, 16 June 2017

4 Conclusions

4.1 Wall Type 1 – Rockwool Duoslab System

Wall Type 1 complies with ADB recommendations in respect of compartmentation, flame spread, combustibility and space separation.

Wall Type 1 complies with the intent of ADB in all aspects and achieves an adequate standard for compliance with Part B.

Wall Type 1 complies with Regulation 7(2) because all new materials achieve A2-s1, d0 or better.

Wall Type 1 achieves a high standard of resistance to fire and smoke spread, and DFC considers additional risk reduction unnecessary and unlikely to be achievable in practice.

4.2 Wall Type 2 – Brick Slip

Wall Type 2 complies with ADB recommendations in respect of compartmentation, flame spread, combustibility and space separation.

Wall Type 2 achieves an adequate standard for compliance with Part B.

Wall Type 2 complies with Regulation 7(2) because the all new materials achieve A2-s1, d0 or better.

Wall Type 2 achieves a high standard of resistance to fire and smoke spread, and DFC considers additional risk reduction unnecessary and unlikely to be achievable in practice.

4.3 Wall Type 3 – AKV Cladding System

Wall Type 3 complies with ADB recommendations in respect of flame spread and combustibility.

Wall Type 3 complies with the intent of ADB in all aspects and achieves an adequate standard for compliance with Part B.

Wall Type 3 complies with Regulation 7(2) because all materials that would become part of the external wall achieve Euroclass A2-s1, d0.

Wall Type 3 achieves a high standard of resistance to fire and smoke spread, and DFC considers additional risk reduction unnecessary and unlikely to be achievable in practice.

4.4 Additional Recommendations

In addition to matters relating to the external construction, DFC recommends that the following measures be put in place:

- A retrospective fire strategy should be produced for the building.
- A comprehensive assessment should be conducted that identifies all fire protection features and systems that are required to provide an adequate standard of health and safety for those in and around the building, including: means of escape provisions; compartmentation, cavity barriers and fire stopping requirements; smoke management systems and facilities for the fire service.
- A fire risk assessment should be conducted that considers general fire precautions as well as any actions required to maintain and ensure the adequacy of the fire protection features and systems.
- Education of the building residents as to the intent of the evacuation strategy. Specifically, that for the majority of fire scenarios, occupants are safe to stay within their flats unless the fire is within the flat. Equally, should they wish to evacuate, they should be safe to do so. If occupants feel there is a need to, and escape routes are clear, they should evacuate.

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- A construction fire risk assessment should be produced by the contractor to ensure that any risks to those in and around the building from any fire during construction are identified and adequate mitigated. This should be coordinated with the buildings' fire risk assessments, which might need updating to reflect findings of the construction fire risk assessment.
- Once the works are completed, the building risk assessments should be updated to acknowledge the external wall constructions such that any changes to the external wall construction through life building addressed in future risk assessments.

Appendix A – Building Regulations 2010

A.1 Part B1: Means of Warning and Escape

Part B1: *“The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times.”*

A.2 Part B2: Internal Fire Spread (Linings)

Part B2(1): *“To inhibit the spread of fire within the building, the internal linings shall –*

(a) adequately resist the spread of flame over their surfaces; and

(b) have, if ignited, a rate of heat release or a rate of fire growth, which is reasonable in the circumstances.”

Part B2(2): *“In this paragraph ‘internal linings’ mean the materials or products used in lining any partition, wall, ceiling or other internal structure.”*

A.3 Part B3: Internal Fire Spread (Structure)

Part B3(1): *“The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period.”*

Part B3(2): *“A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings. For the purposes of this sub-paragraph a house in a terrace and a semi-detached house are each to be treated as a separate building.”*

Part B3(3): *“Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken, to an extent appropriate to the size and intended use of the building, comprising either or both of the following –*

(a) sub-division of the building with fire-resisting construction;

(b) installation of suitable automatic fire suppression systems.”

Part B3(4): *“The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.”*

A.4 Part B4: External Fire Spread

Part B4(1): *“The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.”*

Part B4(2): *“The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.”*

A.5 Part B5: Access and Facilities for the Fire Service

Part B5(1): *“The building shall be designed and constructed so as to provide reasonable facilities to assist firefighters in the protection of life.”*

Part B5(2): *“Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.”*

Appendix B – External Wall Requirements (ADB: 2013)

The following paragraphs list the Approved Document B for ADB: 2006⁹, ADB: 2007¹⁰ and ADB: 2013¹¹ that are relevant to external wall construction. Paragraph numbers are quoted from ADB: 2013.

B.1 Compartmentation

Paragraph 8.25

“Where a compartment wall or compartment floor meets another compartment wall or an external wall, the junction should maintain the fire resistance of the compartmentation. Fire-stopping should meet the provisions of paragraphs 10.17 to 10.19.”

Paragraph 10.17 is not relevant to external walls. Paragraph 10.18 makes recommendations to prevent fire stopping being displaced during a fire. Paragraph 10.19 makes recommendations as to what constitutes effective fire stopping.

Fire stopping should achieve the same fire resistance standard as the compartment wall or floor which is being fire stopped.

Paragraphs 9.3 and 9.9

Paragraph 9.3 and 9.9 recommend that cavity barriers be provided:

- To enclose the edges of cavities, including around openings.
- At the junction between an external cavity wall (except where the cavity wall complies with Diagram 34) and every compartment floor and compartment wall.
- The maximum dimension in any direction between cavity barriers must not exceed:
 - 20m where the cavity surfaces and products are class 1 (national class) or class C-s3, d2 or better (European class), or
 - 10m where the cavity surfaces and products are not class 1 (national class) or class C-s3, d2 or better (European class).

Diagram 34

Diagram 34 recommends that:

- Cavities be faced internally and externally by brick or concrete each at least 75mm thick.
- Cavities be closed around openings.
- Cavities be enclosed at the top of the wall (unless the cavity is totally filled with insulation).

Paragraph 9.13

“Every cavity barrier should be constructed to provide at least 30 minutes fire resistance. It may be formed by any construction provided for another purpose if it meets the provisions for cavity barriers (see ADB Appendix A, Table A1, item 15).”

⁹ HM Government, The Building Regulations 2000, Approved Document B (Fire Safety), Volume 2 – Building other than dwellinghouses, 2006’, HMSO

¹⁰ HM Government, The Building Regulations 2000, Approved Document B (Fire Safety), Volume 2 – Building other than dwellinghouses, 2006 edition amended 2007’, HMSO

¹¹ HM Government, The Building Regulations 2010, Approved Document B (Fire Safety), Volume 2 – Building other than dwelling houses, 2006 edition incorporating 2007, 2010 and 2013 amendments’, HMSO

Cavity barriers in a stud wall or partition, or provided around openings may be formed of:

- a. steel at least 0.5mm thick;
- b. timber at least 38mm thick;
- c. polythene-sleeved mineral wool, or mineral wool slab, in either case under compression when installed in the cavity; or
- d. calcium silicate, cement-based or gypsum-based boards at least 12mm thick.”

B.2 Flame Spread

Paragraph 12.5

“External walls should either meet the guidance given in paragraphs 12.6 to 12.9 or meet the performance criteria given in the BRE Report¹² (BR 135) for cladding systems using full scale test data from BS 8414-1¹³ or BS 8414-2¹⁴.”

Paragraph 12.6

“The external surfaces of walls should meet the provisions in Diagram 40.”

For a residential building greater than 18m in height with no part of any external wall within 1000mm of any boundary, Diagram 40 requires that:

- The external surface of any part of any external wall higher than 18m above adjacent ground must:
 - achieve class 0 (national standard) or class B-s2, d2 or better (European class), or
 - be profiled or flat steel sheet at least 0.5mm thick with an organic coating of no more than 0.2mm thickness.
- The external surface of any part of any external wall less than 18m above adjacent ground must:
 - achieve Index (I) not more than 20 (national standard) or class C-s2, d2 or better (European class) or better, or
 - be timber cladding at least 9mm thick.

Refer to Appendix D for information regarding national standard and European class classifications.

B.3 Combustibility

B.3.1 General

Paragraph 12.5

“External walls should either meet the guidance given in paragraphs 12.6 to 12.9 or meet the performance criteria given in the BRE Report (BR 135) for cladding systems using full scale test data from BS 8414-1 or BS 8414-2.”

¹² S Colwell and T Baker, ‘Fire performance of external thermal insulation for walls of multistorey buildings: (BR 135) Third edition’, 2013, BRE Press

¹³ BS 8414: Part 1, ‘Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems applied to the face of building’, 2002

¹⁴ BS 8414: Part 2, ‘Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems fixed to and supported by a structural steel frame’, 2005

For the purposes of this report, the above options are referred to as 'Limited Combustibility' and 'Fire Testing' respectively. Additionally, ADB paragraphs 12.6 to 12.9 enable a third option, herein referred to as 'Encapsulation'. These options are detailed below.

B.3.2 Limited Combustibility Option

The ADB requirements for the limited combustibility option are as defined below.

Paragraph 12.6

See Appendix B.2.

Paragraph 12.7

"In a building with a storey 18m or more above ground level any insulation product, filler material (not including gaskets, sealants and similar) etc. used in the external wall construction should be of limited combustibility (see Appendix A). This restriction does not apply to masonry cavity wall construction which complies with Diagram 34 in Section 9."

Paragraph 12.8

"Cavity barriers should be provided in accordance with Section 9."

Paragraph 12.9

"In the case of an external wall construction, of a building which, by virtue of paragraph 9.10d (external cladding system with a masonry or concrete inner leaf), is not subject to the provisions of Table 13 Maximum dimensions of cavities in non-domestic buildings, the surfaces which face into cavities should also meet the provisions of Diagram 40."

B.3.3 Fire Testing Option

The BR 135 requirements and performance criteria are:

- *The test specimen should be installed with all the relevant components, and should be assembled in accordance with the manufacturer's instructions.*
- *The system must have been tested to the full test-duration requirements of BS 8414 without any early termination of the full fire-load exposure period.*
- *The start time, t_s , for fire spread is initiated when the temperature first recorded by any external thermocouple at level 1 equals or exceeds a 200 °C temperature rise above the start temperature, T_s , and remains above this value for at least 30s.*
- *Failure due to external fire spread is deemed to have occurred if the temperature rise above T_s of any of the external thermocouples at level 2 exceeds 600°C for a period of at least 30s, within 15 min of the start time, t_s .*
- *Failure due to internal fire spread is deemed to have occurred if the temperature rise above T_s of any of the internal thermocouples at level 2 exceeds 600°C, for a period of at least 30s, within 15 min of the start time, t_s .*
- *Ongoing system combustion following extinguishing of the ignition source shall be included in the test and classification reports, together with details of any system collapse, spalling, delamination, flaming debris or pool fires. The nature of the mechanical performance should be considered as part of the overall risk assessment when specifying the system.*

In addition, for BS 8414-2 tests the following criterion is applied for internal fire spread:

- *Where system burn-through occurs so that fire reaches the internal surface, failure is deemed to have occurred if continuous flaming, defined as a flame with a duration in excess of 60s, is observed on the internal surface of the test specimen at or above a height of 0.5 m above the combustion chamber opening within 15 min of the start time, t_s .*

B.3.4 Encapsulation Option

Combustible materials can be placed within a cavity within an external wall provided that complies with Diagram 34 (see Appendix B.1).

B.3.5 Interpretation of Recommendations

The literal interpretation of paragraph 12.7 is that its scope is limited to insulation and filler material only. However, to assess compliance with ADB: 2013 with respect to combustibility, it is important to consider both the risk which paragraph 12.7 is intending to mitigate and the mechanism by which it attempts to mitigate risk.

Risk

ADB paragraph 12.5 states that, “The external envelope of a building should not provide a medium for fire spread if it is likely to be a risk to health or safety. The use of combustible materials in the cladding system and extensive cavities may present such a risk in tall buildings.”

In other words, the concern is in relation to combustible materials (as opposed to only insulation and fillers).

Intended Mitigation

The intent of paragraph 12.7 is to mitigate the risk of fire spread by limiting the combustibility of materials. To be successful, this would have to apply to any combustible material that could be exposed to fire regardless of whether it is nominally insulation or filler material (i.e. calling a material something other than insulation or filler does not mean that it would resist fire spread any more than if it were called insulation or filler).

DFC Interpretation

DFC interprets the scope of ADB paragraph 12.7 to include any item that covers large areas of the external wall and that is sufficiently thick that if ignited could result in external fire spread over the external wall construction. Under this interpretation, sheathing boards and rain screens are included within the scope of paragraph 12.7

B.4 Space Separation

Paragraph 14.9

“If an external wall has the appropriate fire resistance, but has combustible material more than 1mm thick as its external surface, then that wall is counted as an unprotected area amounting to half the actual area of the combustible material, see Diagram 43. (For the purposes of this provision, a material with a Class 0 rating (National class) or Class B-s3, d2 rating (European class) [see Appendix D] need not be counted as unprotected area).”

Appendix C – Alternative Approaches

C.1 Legislative Framework

The Building Regulations provide functional requirements and the Regulatory Reform (Fire Safety) Order is risk based. Government guidance is provided for both legislations, but compliance with the guidance is not mandatory.

Therefore, alternative approaches can be valid and in certain circumstances might be necessary.

C.2 Alternatives to Approved Document B

Designers often adopt one or a combination of two alternatives approaches to following the prescriptive guidance of Approved Document B (ADB):

- **Equivalence:** Demonstrating qualitatively or quantitatively that the proposed design achieves an equivalent standard to that of a similar design that complies with ADB recommendations.
- **Holistic Risk Assessment:** Demonstrating qualitatively or quantitatively that the proposed design complies with the functional requirements of the Part B of Schedule 1 to the Building Regulations.

These approaches have been recognised by the Building Control Alliance in their Guidance Note 18¹⁵. Option 3 (Equivalence) and Option 4 (Holistic Risk Assessment) are alternative options which can be used to demonstrate compliance with Part B4(1). Neither option is referenced in ADB, and therefore, neither carries the same legal status as the first two options.

C.2.1 Equivalence

If no actual fire test data exists for a particular system, the client may instead submit a desktop study report from a suitably qualified fire specialist stating whether, in their opinion, BR135 criteria would be met with the proposed system. The report should be supported by test data from a suitable independent UKAS accredited testing body (BRE, Chiltern Fire or Warrington Fire) and so this option may not be of benefit if the products have not already been tested in multiple situations / arrangements. The report should also specifically reference the tests which have been carried out on the product.

C.2.2 Holistic Risk Assessment

If none of the above options are suitable, the client may consider addressing this issue via a holistic fire engineered approach taking into account the building geometry, ignition risk, factors restricting fire spread etc. Such an approach would be expected to follow a recognised design code such as the BS 7974 Application of fire safety engineering principles to the design of buildings suite of documents and be supported with quantitative analyses where appropriate.

C.2.2.1 Principles of a Holistic Risk Assessment

The functional requirements of the building regulations for fire safety are split into five parts. Guidance in ADB: 2013 is provided separately for each of the five parts. However, as per ADB: 2013 paragraph 0.4, it is recognised that the provisions are interlinked, and a higher standard in one part might provide benefit in another part. That said, it is reasonable to assume that a minimum standard must be achieved in each part.

Therefore, provided it provides some resistance to fire spread over the walls of the building, it is possible where an external wall construction does not comply with the ADB: 2013 recommendations, the associated risk can be mitigated by an over provision in another area.

¹⁵ BCA Technical Guidance Note 18, Use of Combustible Cladding Materials on Buildings Exceeding 18m in Height, Building Control Alliance, Issue 1, January 2015.

That mitigation might already exist within the design or it might require measures in addition to those that already exist.

For any potential mitigation measure(s) to be adequate, it must reduce overall risk by at least as much as it is increased by the external wall not complying with ADB: 2013.

Risk is the product of frequency of a fire occurring and the likely consequence.

Risk = frequency x likelihood x consequence

Therefore, mitigation measures must reduce frequency of fire, the likelihood of it causing a hazard and/or the consequence of the hazard. In this case, the hazard occurring is fire spread via the external walls. Therefore, potential mitigation measures are listed below.

Frequency

Measures to reduce frequency of fires resulting in fire spread over external wall construction include:

- Reduction or removal of ignition sources and fire load outside the building.
- Reduction or removal of ignition sources and fire load inside the building.
- Provision of sprinklers within the building.

Likelihood

Measures to reduce likelihood of fire spread over external wall construction include:

- Remedial work to / removal of the external wall construction.
- Provision of fire breaks within the external wall construction.
- External fire fighting measures.

Consequence

Measures to reduce consequence of fire spread over external wall construction include:

- Sealing the external wall to ensure that fire and smoke cannot spread to the inside of the building.
- In residential buildings, providing measures to ensure that occupants can evacuate away from the perimeter of the building to a safe place within or outside the building before fire spread becomes hazardous.

Appendix D – Material and Product Classifications

D.1 Combustibility

D.1.1 Non Combustible

ADB Appendix A paragraph 8 and Table A6 defines the following materials as non-combustible:

- Products classified as non-combustible under BS 476-4¹⁶, or
- Any material which when tested BS 476-11¹⁷ does not flame nor cause any rise in temperature on either the centre (specimen) or furnace thermocouples, or
- European classes) when classified as class A1 in accordance with BS EN 13501-1¹⁸ when tested to BS EN ISO 1182¹⁹ and BS EN ISO 1716²⁰, or
- Totally inorganic materials such as concrete, fire clay, ceramics metals, plaster and masonry containing not more than 1% by weight or volume of organic material, or
- Concrete bricks or blocks meeting BS EN 771-3:2003, or
- Products made from one or more of the materials considered as Class A1 without the need for testing as defined in Commission Decision 2003/424/EC of 6th June 2003 amending Decision 96/603/EC establishing the list of products belonging to Classes A1 “No contribution to fire” provided for in the Decision 94/611/EC implementing Article 20 of the Council Directive 89/106/EEC on construction products. None of the materials shall contain more than 1% by weight or volume (whichever is the more onerous) of homogeneously distributed organic material.

D.1.2 Limited Combustibility

ADB Appendix A paragraph 9 and Table A7 defines the following materials as non-combustible:

- Any non-combustible material listed above, or
- Any material of density 300kg/m³ or more, which when tested to BS 476-11, does not flame and the rise in temperature on the furnace thermocouple is not more than 20°C, or
- Any material/product classified as Class A2-s3, d2 or better in accordance with BS EN 13501-1, or
- (for external wall construction) Any material of density less than 300kg/m³, which when tested to BS 476-11, does not flame for more than 10 seconds and the rise in temperature on the centre (specimen) thermocouple is not more than 35°C and on the furnace thermocouple is not more than 25°C, or
- Any material with a non-combustible core at least 8mm thick having combustible facings (on one or both sides) not more than 0.5mm thick. (Where a flame spread rating is specified, these materials must also meet the appropriate test requirements).

¹⁶ BS 476: Part 3, Fire tests on building materials and structures. Non-combustibility test for materials', 1970

¹⁷ BS 476: Part 11, 'Fire tests on building materials and structures. Method for assessing the heat emission from building materials', 1982

¹⁸ BS EN 13501: Part 1, 'Classification using data from reaction to fire tests', 2007

¹⁹ BS EN ISO 1182, 'Reaction to fire tests for building products. Non-combustibility test', 2010

²⁰ BS EN ISO 1716, 'Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)', 2010

D.2 Surface Spread of Flame

D.2.1 National Class

D.2.1.1 General

Under the national classifications, lining systems which can be effectively tested for 'surface spread of flame' are rated for performance by reference to the method specified in BS 476-7²¹, under which materials or products are classified 1, 2, 3 or 4 with Class 1 being the highest.

D.2.1.2 Class 0

ADB Appendix A paragraph 13 defines materials or surfaces as achieving a class 0 rating if it is:

- Composed throughout of materials of limited combustibility, or
- A class 1 material which has a fire protection index (I) of not more than 12 and sub-index (i1) of not more than 6.

In addition, ADB Table A8 lists some generic materials and products that typically achieve a class 0 performance:

- Brickwork, blockwork, concrete, ceramic tiles.
- Plasterboard (painted or not with a PVC facing not more than 0.5mm thick) with or without an air gap or fibrous or cellular insulating material behind.
- Woodwool cement slabs.
- Mineral fibre tiles or sheets with cement or resin binding.

D.2.2 European Class

Under the European classifications, lining systems are classified in accordance with BS EN 13501-1 as A1, A2, B, C, D, E or F, with A1 being the highest. When a classification includes "s3, d2", it means that there is no limit set for smoke production and/or flaming droplets/particles.

²¹ BS 476: Part 7, 'Method of test to determine the classification of the surface spread of flame of products', 1997.

Quality Assurance

This report has been prepared for the use by, and takes into account the particular instructions and requirements of our Client. It is not intended for use by any third party, and Design Fire Consultants Ltd shall not be liable for the reliance on or use of the report by any third party.

Revision	Date	Issue Description	Author	Checked
07	06 Apr 2020	Brick slips changed to Permarock.	N Butterworth 	N Butterworth 
06	02 Oct 2019	Typo amendments.	N Butterworth 	N Butterworth 
05	04 Sep 2019	Updated to reflect impact of 2018 regulation changes on Wall Types 1 and 2 and change of cladding type in Wall Type 3.	N Butterworth 	N Butterworth 
04	30 Jul 2019	Updated to reflect impact of 2018 regulation changes on Wall Types 1 and 2 and change of cladding type in Wall Type 3.	N Butterworth 	N Butterworth 
03	19 Jan 2018	Updated following client comments.	N Butterworth 	N Butterworth 
02	12 Dec 2017	Section 3.2.1 and 4.1 titles changed to match Section 2.2.	N Butterworth 	N Butterworth 
01	08 Dec 2017	Updated following internal review and client comment.	N Butterworth 	N Swailes 
00	28 Nov 2017	Issued in draft form for client review and comment.	N Butterworth DRAFT	N Swailes DRAFT