



BRE: The Fire Performance of Building Envelopes

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Part of the BRE Trust



Objectives

The UK & International experience

Regulatory framework in the UK

Fire Testing of Facades

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Façade Fire Examples

Fire Spread in Building Envelopes

- Knowsley Heights - 1991
- Basingstoke - 1992
- Irvine - 1999
- Paddington, London – 2003
- The Edge, Manchester – 2004
- Windsor Tower, Madrid – 2005
- Berlin 2005
- Hungary 2009
- Dijon France 2010
- Chechnya
- UAE
- USA

Fire Spread in Building Envelopes

- Al Nahda Tower, Sharjah 28th April 2012
- Mermoz Roubaix, France 15th May 2012
- Polat Tower, Istanbul, Turkey, 17th July 2012
- Tamweel Tower, Dubai, 18th November 2012
- The Torch Dubai February 2015
- Azerbaijan May 2015
- The Address. Dubai December 2015

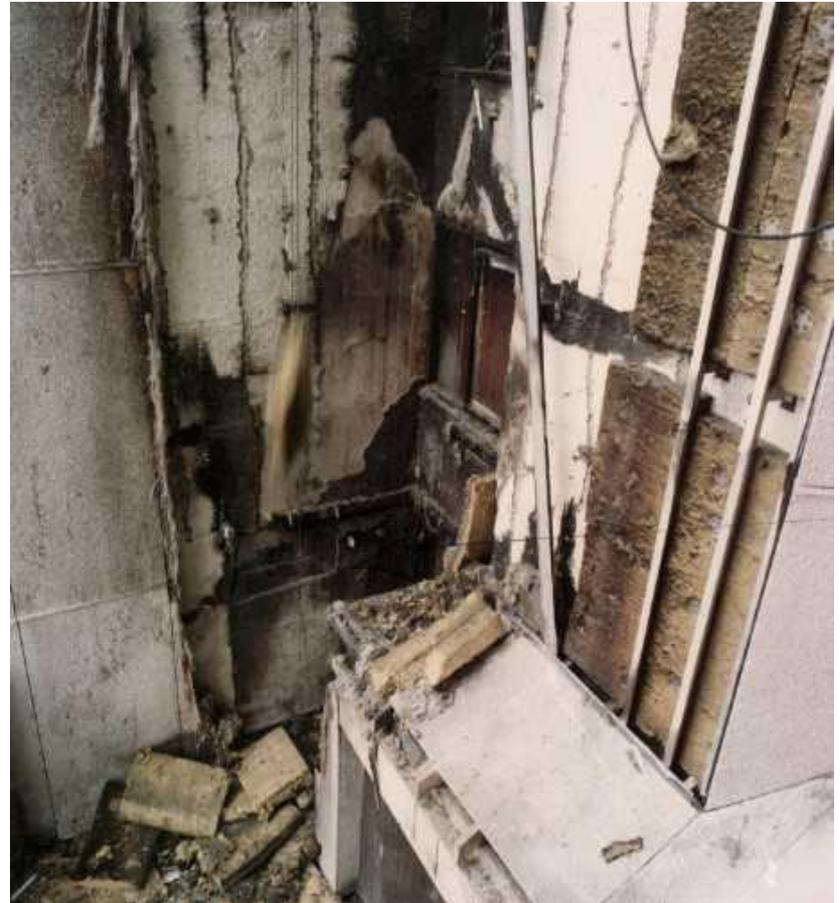
Fire Spread in Building Envelopes

- <http://www.miragenews.com/building-fire-kills-16-injures-at-least-50-in-azerbaijan/>

Knowsley Heights - 1991



Knowsley Heights – 1991



External Fire Spread – Basingstoke 1992



External Fire Spread – Irvine 1999

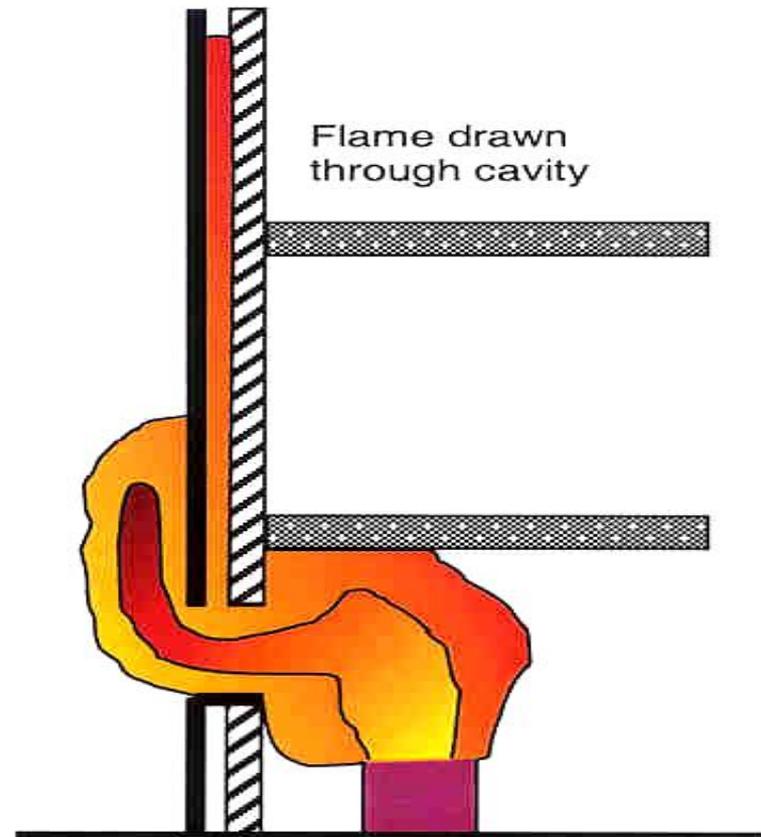


- 11th June 1999
- 5th Floor Flat
- 14 Storey Block
- In the summer of 1999, a Parliamentary inquiry into the potential risk of fire spread in buildings via External Cladding was held by the Environment Sub-committee of the Environment Transport and Regional affairs committee.

Mechanisms of fire spread in Façades

Mechanisms of External Fire Spread

- Combustible materials
- Cavities either
 - Part of system.
 - Created by delamination.
- Flames in cavities can extend 5 to 10 times original length regardless of materials present.



Some calculations and assumptions

- A square building 180m high
- With a footprint of 180m.
- There is a 12mm layer of combustible material that covers all four faces of the building.
- You have a fire incident that involves just one of the faces of the building.

Some calculations and assumptions

- Surface area of building – $180\text{m} \times 180\text{m} = 32400\text{m}^2$
- Divide by 4 (one face of the building) 8100m^2
- Volume of material = $8100\text{m}^2 \times 0.012\text{m}$
- 81 cubic metres of material on the outside of the building.
- Equivalent of 2812.5 sheets of $2.4\text{m} \times 1.2\text{m} \times 12\text{mm}$ thick

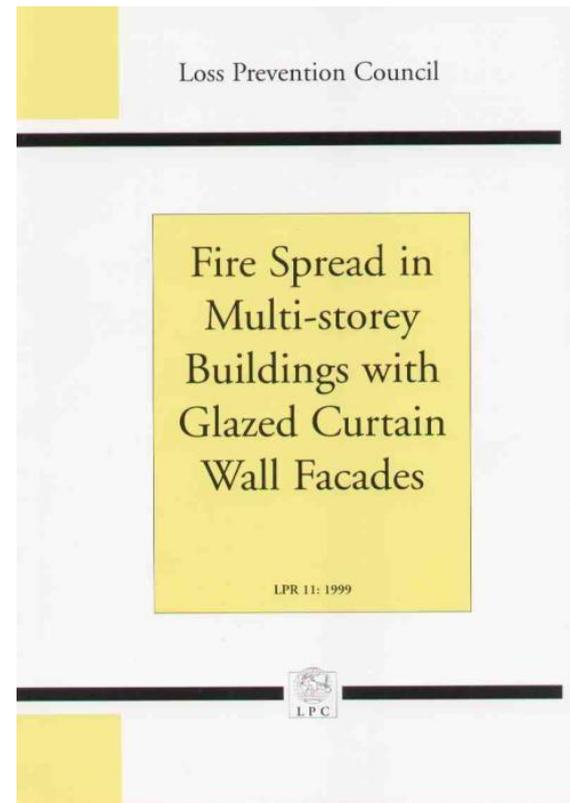
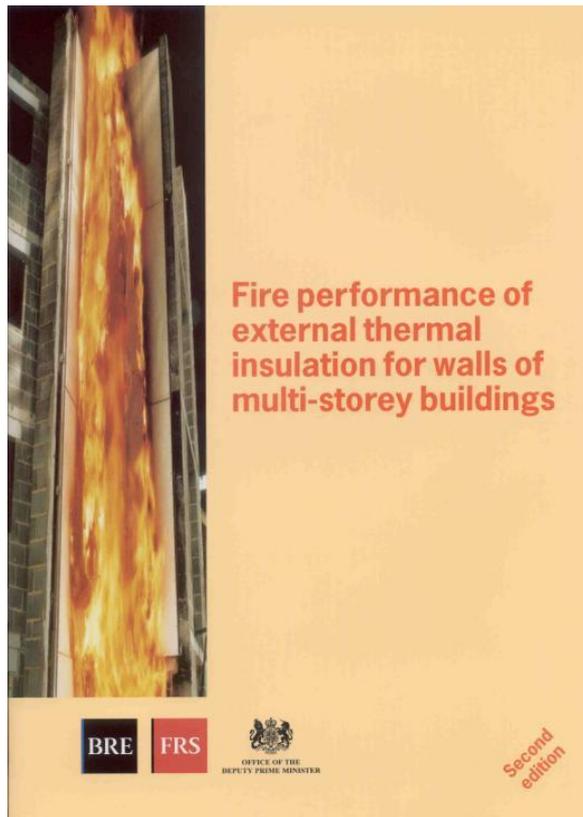
Some calculations and assumptions

- The above calculations are conservative.
- 180 metres is not high for a building
- Empire State building 381metres.
- Insulation systems are typically 100mm +
- 200mm is not uncommon.

Experimental Programmes – Fire Spread



Experimental investigations



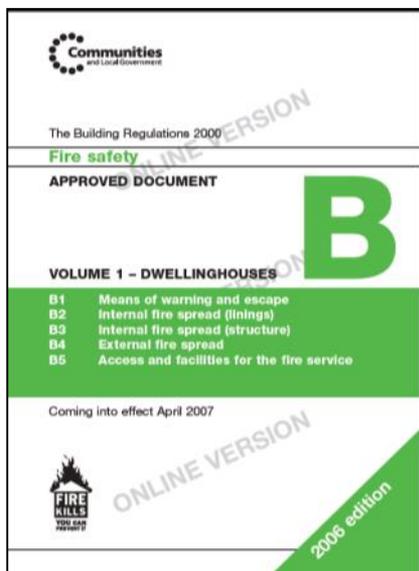
Standards

- BS8414 Part 1- 2015
- BS8414 Part 2 - 2015

Building Regulation Guidance – Approved Document B

Building Regulations (Fire Safety) – Guidance

- Approved Document B (ADB)
 - Two Volumes



Building Regulations - Fire safety Functional Requirements

B1 Means of Warning and Escape

B2 Internal Fire Spread (Linings)

B3 Internal Fire Spread (Structure)

B4 External Fire Spread

B5 Access and Facilities for the Fire Service

Address Life Safety Issues

External Walls over 18m in Height

- A summary of Volume 2 Section 12
 - External surfaces comply with Diagram 40 'Euroclasses'. Applicable to all buildings.

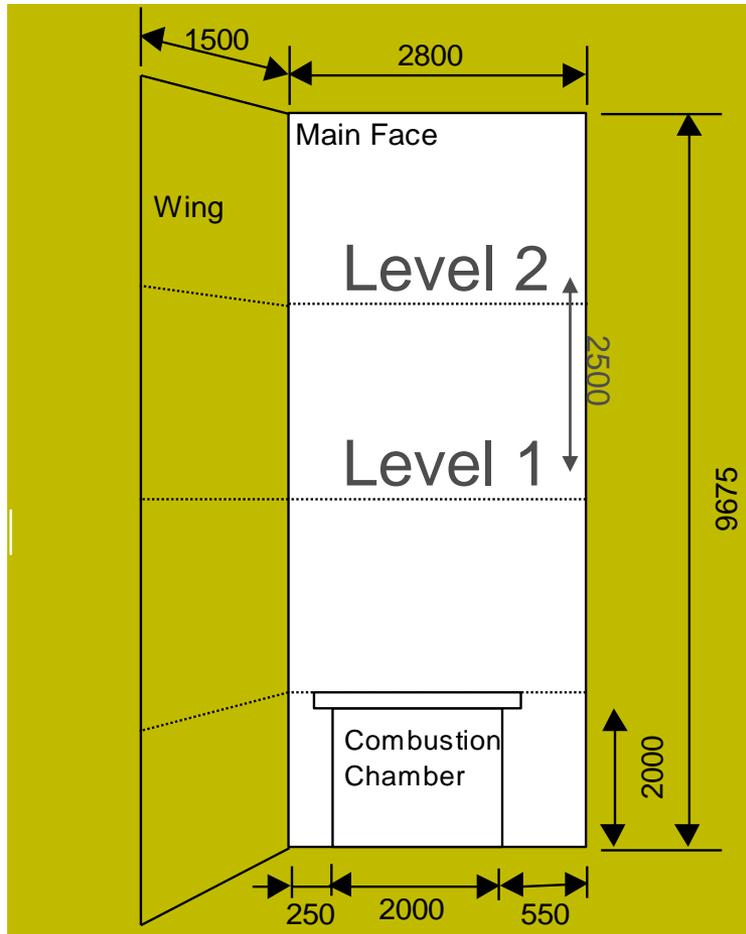
Additional recommendations for buildings with a storey over 18m

- All insulation and filler materials should be A2-s3,d2 or better
- All cavity barriers and fire stopping guidance needs to be followed
- OR
 - Test the complete system to BS 8414

Testing facilities

- Located at BRE Watford
- Indoor test facilities.
- 4 faces that can be adapted for Part 1 and 2 systems

Test system



- Minimum height of sample:
 - 6 m above chamber opening
 - ground to full height on wing
- Width:
 - 2.8 m main face
 - 1.5 m wing
- Depth:
 - Part 1 - Maximum sample depth 200 mm

BS 8414: Part 1: 2002

- Test method for non-load bearing external cladding systems applied to the face of the building
- This test method was developed to address systems installed to masonry structures.



Location of Thermocouples at Level 2

Internal structure

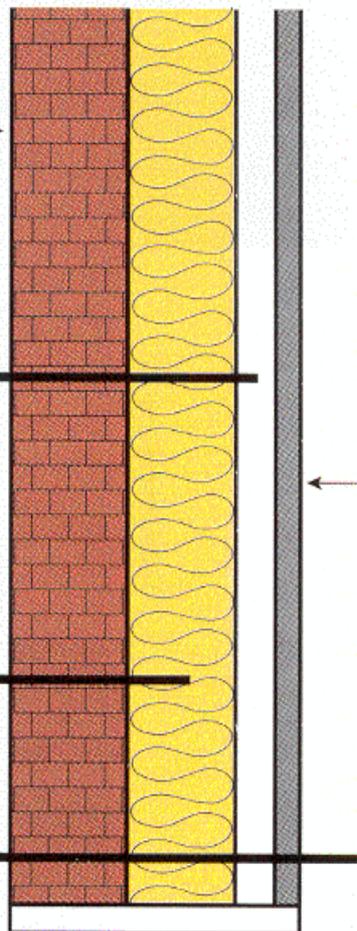
Internal wall of test facility

Thermocouple located at the mid-depth of the cavity (if present)

Thermocouple located at the mid-depth of the insulating material layer

External thermocouple

External finish. No mid-depth temperature monitoring if layer is <10 mm thick



Fire Load

1500mm x 1000mm x 1000mm timber crib

50mm x 50mm cross section

Each crib consists of 250 sticks

Moisture content of crib controlled 10%-16% by mass

Crib is ignited with fibre board and white spirit

Fire Load

Crib output 4500 MJ over 30 mins

3.0(+/- 5) MW peak output

Test Principles



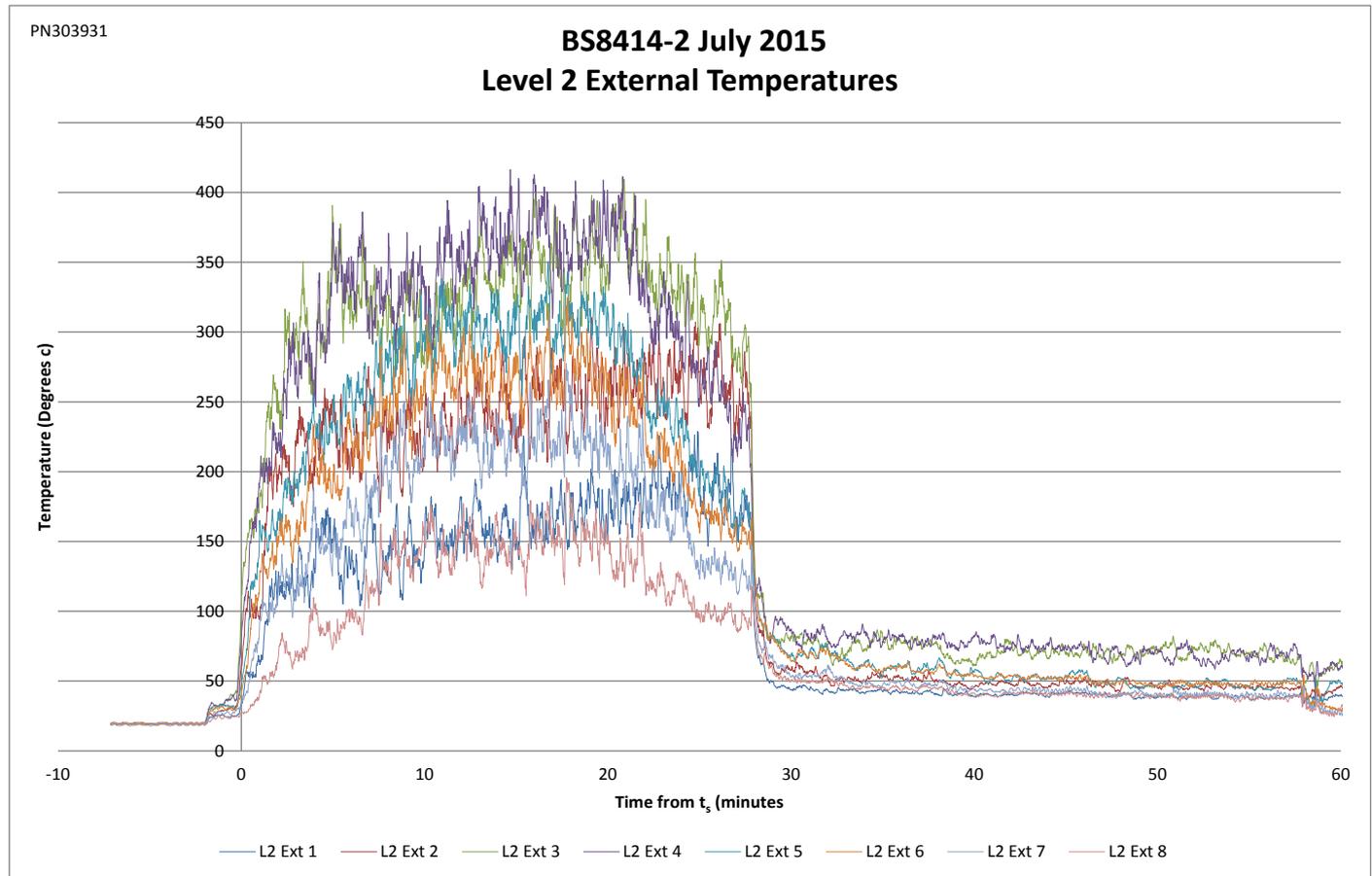
The duration of the fire load is 30 minutes. Test runs for 60 minutes

Post Test



- Damage is recorded in the following areas:
 - flame spread on surface
 - flame spread in cavities or insulation
 - area of façade damaged or detached
- Primary Pass/Failure criteria BR135
 - Time/temperature at Level 2, 600 deg C at 15 minutes – although other classification parameters can and are applied.

Graphical Output



Set one

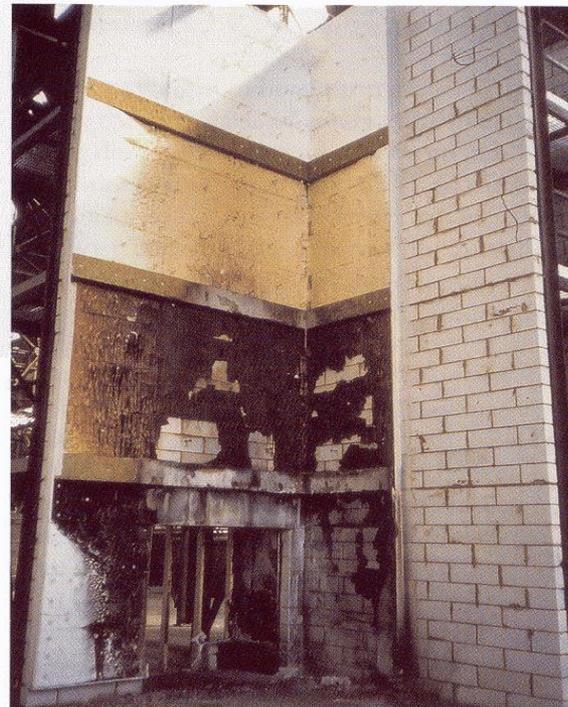


Set two



Assessment of System Performance

- Test method to assess whole system performance including fire breaks



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Lightweight Frame Systems

Modern Methods of Construction

- BS 8414 - 2 : 2005
 - For systems where the masonry structure is no longer present.
 - Same fire load and methodology at BS 8414-1:2002
 - Classification is in Annex B to BR135



Currently testing systems for

- UK Building Regulations
- UAE and Gulf states
- Australia
- We understand that China uses a test method adapted from BS8414.
- BS 8414 test is being called up in a number of countries equivalent to Approved Document B.

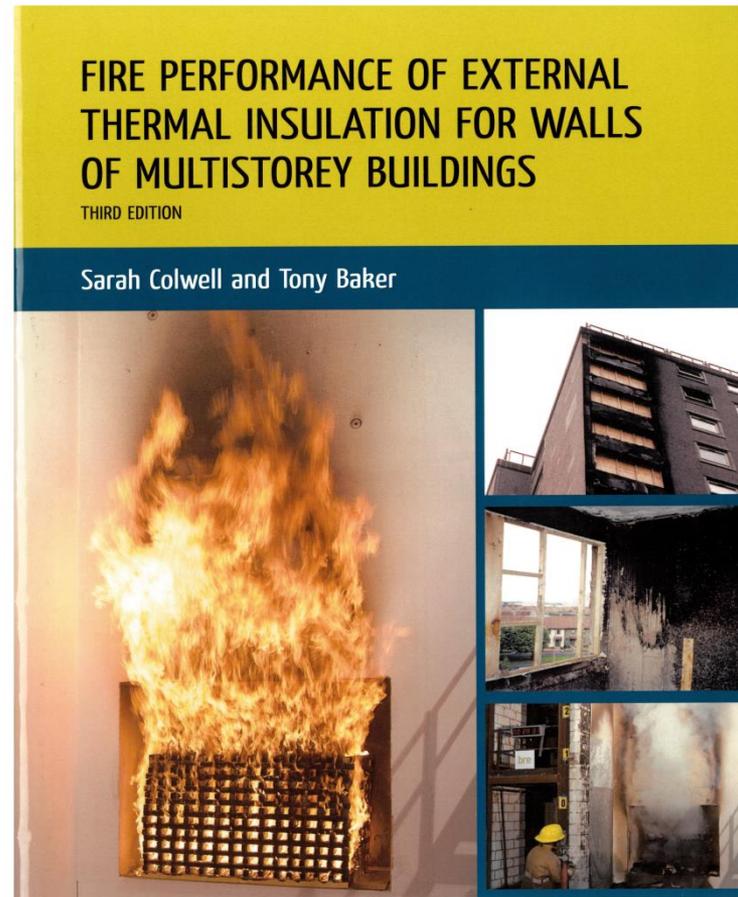
Current operating third party approvals – ‘LPCB’

For UK insurance industry

UAE and Gulf states

External Fire Spread Classification UK

BR 135 – Third
Addition



Thank you

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