LPCB

Protecting People, Property and the Planet

# External Fire Spread on High Rise Buildings

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# Objectives

## Objectives

- Incidents
- Mechanisms of External Fire Spread
- Full scale Façade Testing
- Examples of application
- Summary and Questions

# What is a Façade ?

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## What is a Façade ?

- The building envelope (typically 15 ° to the building face)
- Materials
  - Timber
  - Plastics
  - GRP
  - Glazing
  - Polymeric composites
  - Cement based products
  - With and without insulation
- It is frequently a kit of parts

# Examples of External Fire Spread

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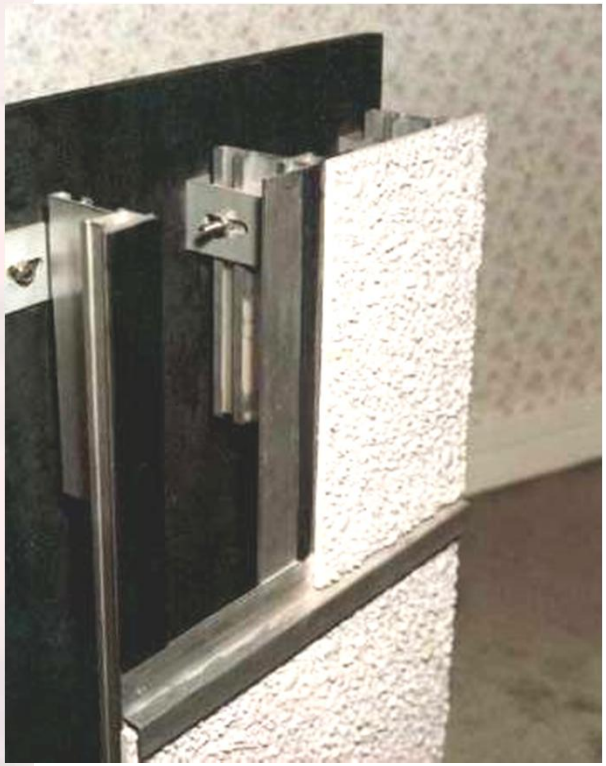
# Fire Spread in Building Envelopes

Fires involving multi-storey buildings are

- a risk to life
- a risk of property loss
- a disruption to commercial business or
- to domestic life if dwellings are involved.

- Knowsley Heights - 1991
- Basingstoke - 1992
- Irvine - 1999
- Paddington, London – 2003
- The Edge, Manchester – 2004
- Windsor Tower, Madrid - 2005

# Knowsley Heights - 1991



# Knowsley Heights – 1991

# Basingstoke (1992)

# 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.

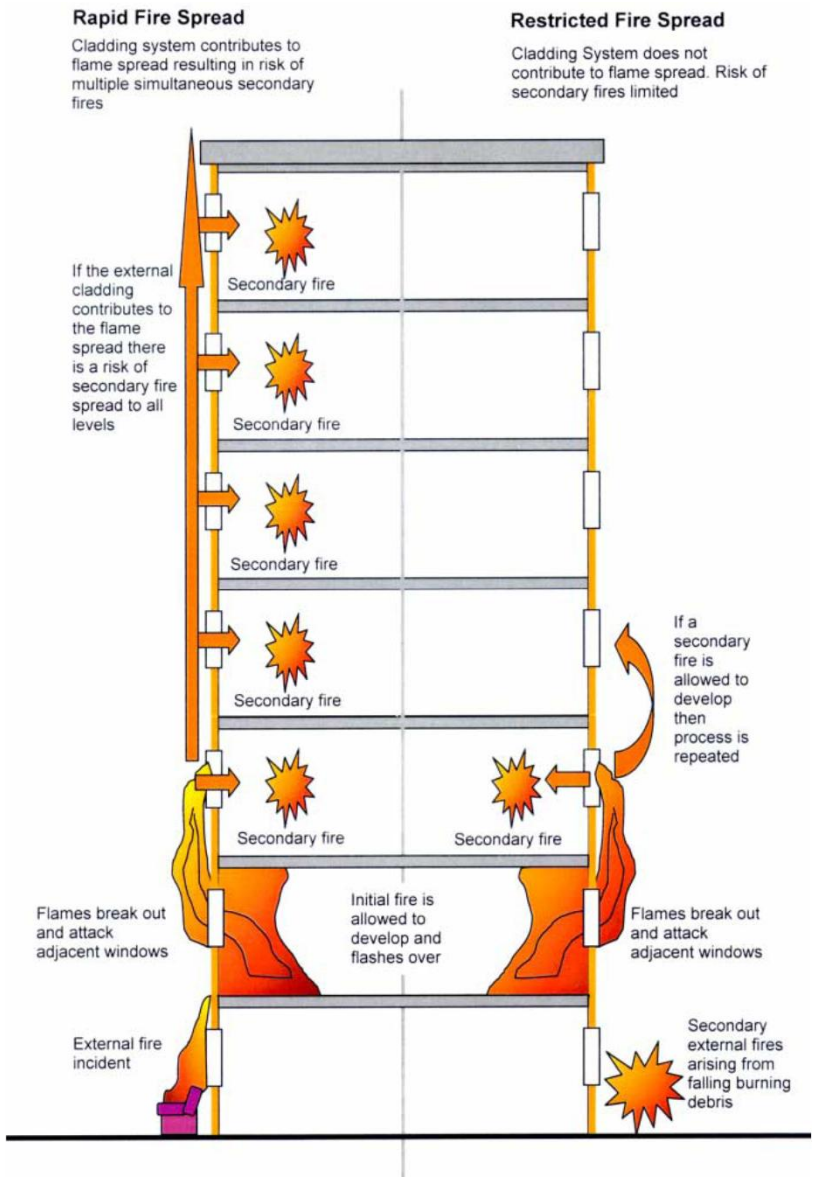
# Dijon, France – 2010

Seven people killed and 11 seriously injured by a fire in a nine-storey hostel in the eastern French city of Dijon.

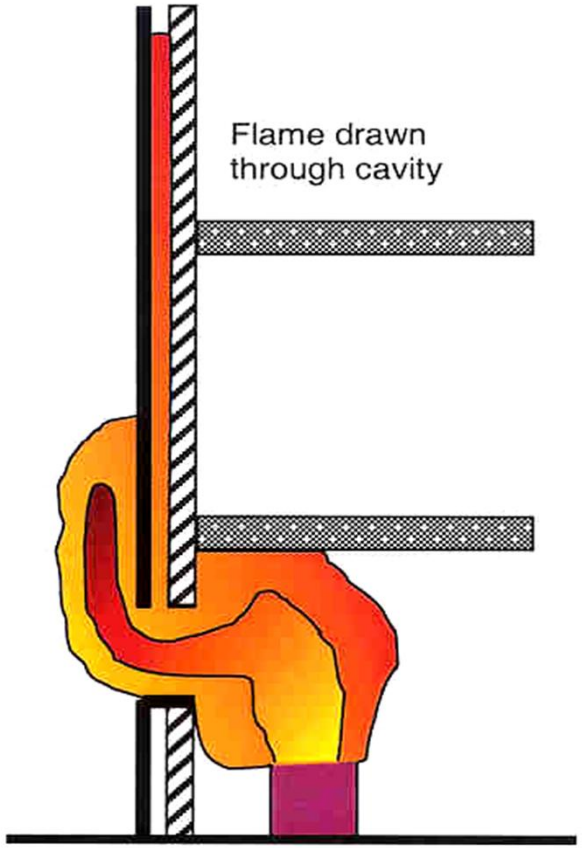
# High Rise External Cladding Fires in 2012

- Al Nahda Tower, Sharjah 28th April 2012
- Mermoz Roubaix, France 15th May 2012
- Polat Tower, Instanbul, Turkey, 17th July 2012
- Tamweel Tower, Dubai, 18th November 2012

# Mechanisms of fire spread

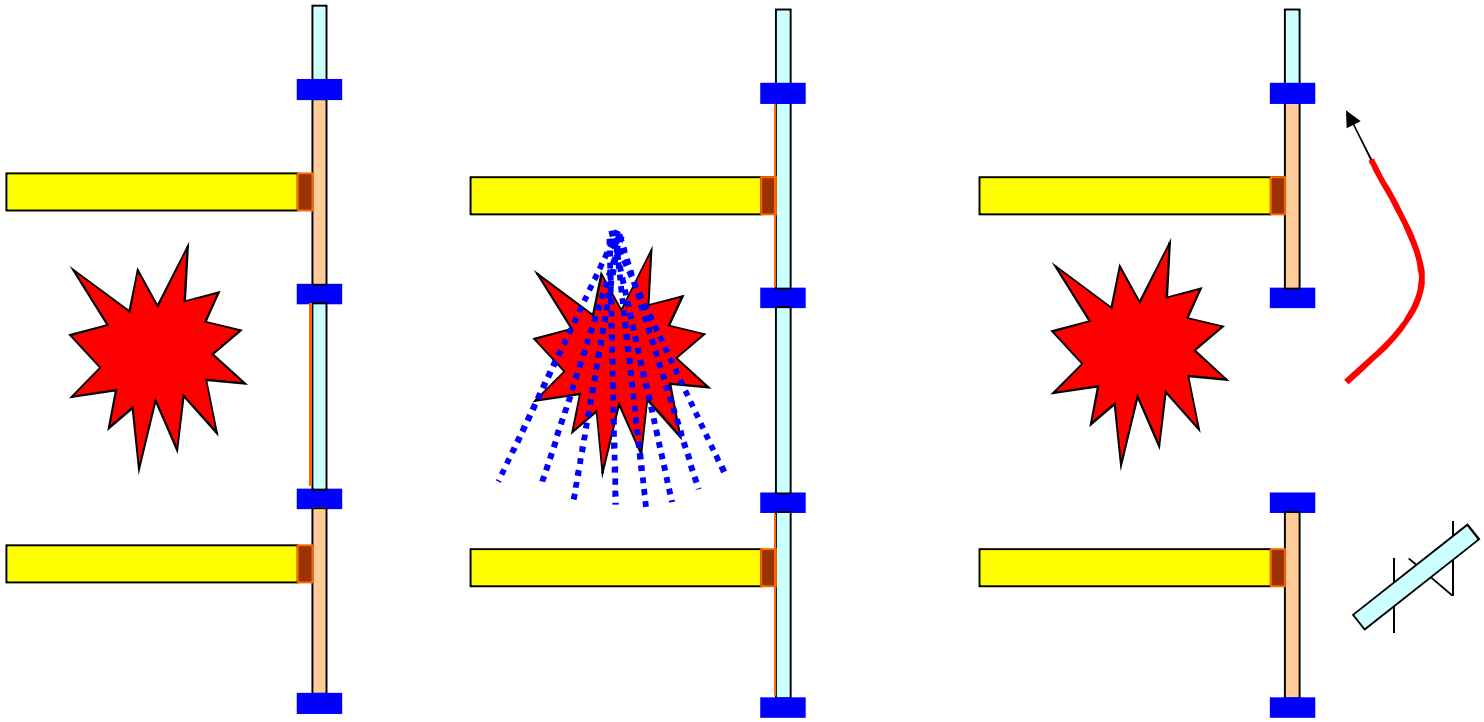

Rapid Fire Spread
Cladding system contributes to flame spread resulting in risk of multiple simultaneous secondary fires
Restricted Fire Spread
Cladding System does not contribute to flame spread. Risk of secondary fires limited
If the external cladding contributes to the flame spread there is a risk of secondary fire spread to all levels
Secondary fire
Secondary fire
Secondary fire
Secondary fire
Secondary fire
Secondary fire
If a secondary fire is allowed to develop then process is repeated
Flames break out and attack adjacent windows
Initial fire is allowed to develop and flashes over
Flames break out and attack adjacent windows
External fire incident
Secondary external fires arising from falling burning debris

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



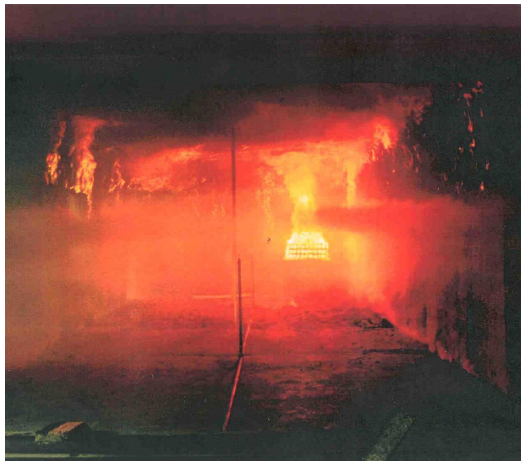
# Fire Spread

Fire resistant walls, sprinklers, fire resistant panels



# Fire Testing

# Test Scale & Systems



# Experimental Programmes – Fire Spread

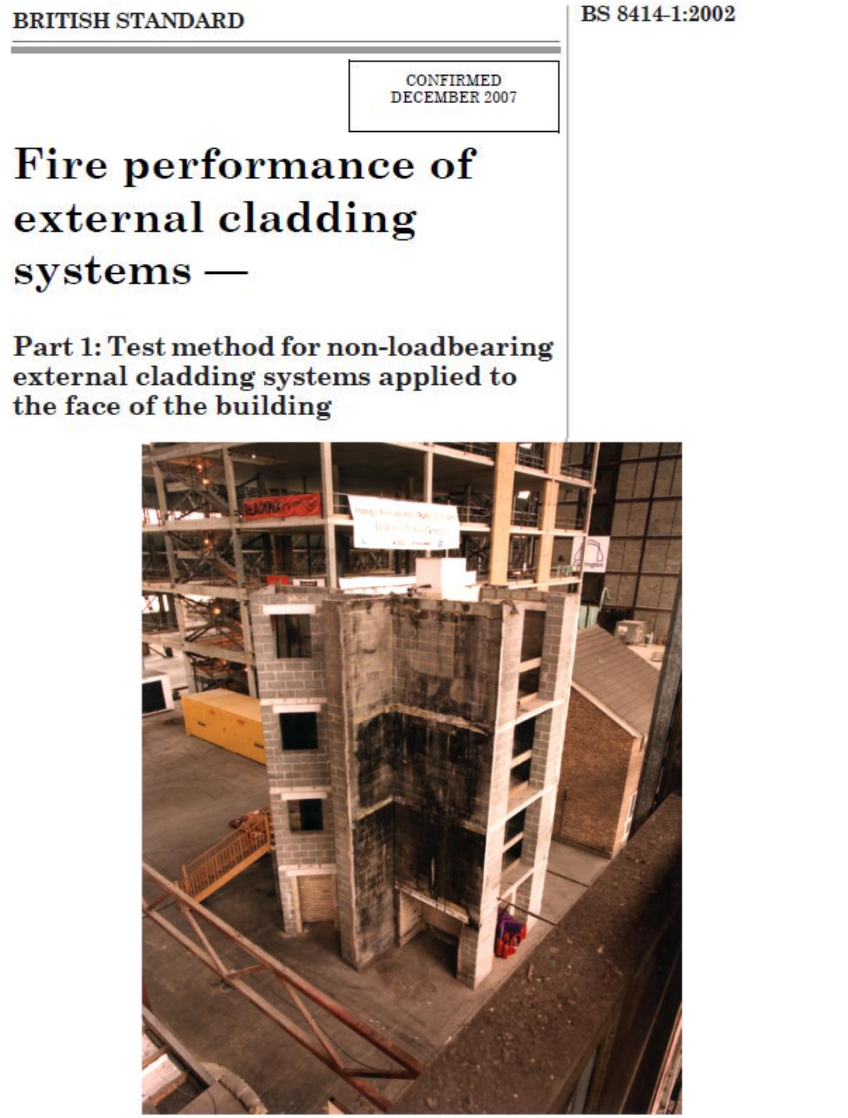

# Test Principles

- BS 8414-1
  - Masonry Systems
- BS 8414-2
  - Lightweight frame System

# 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.



# BS 8414 - 2 : 2005

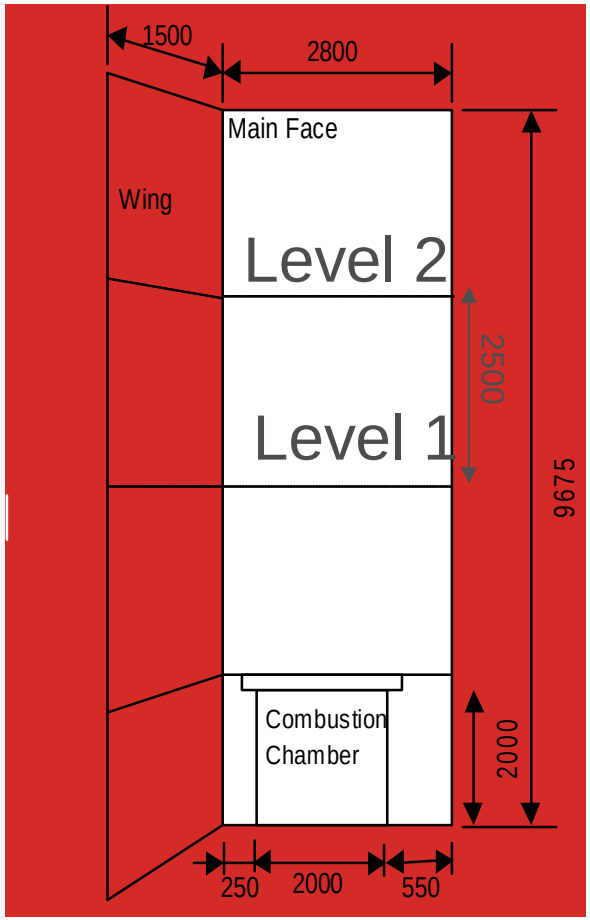
- For systems where the masonry structure is no longer present.
- Same fire load and methodology as BS 8414-1:2002

# Test Principles

– The duration of the fire load is 30 minutes.

– Test runs up to 60 minutes

# Test Facility and Sample



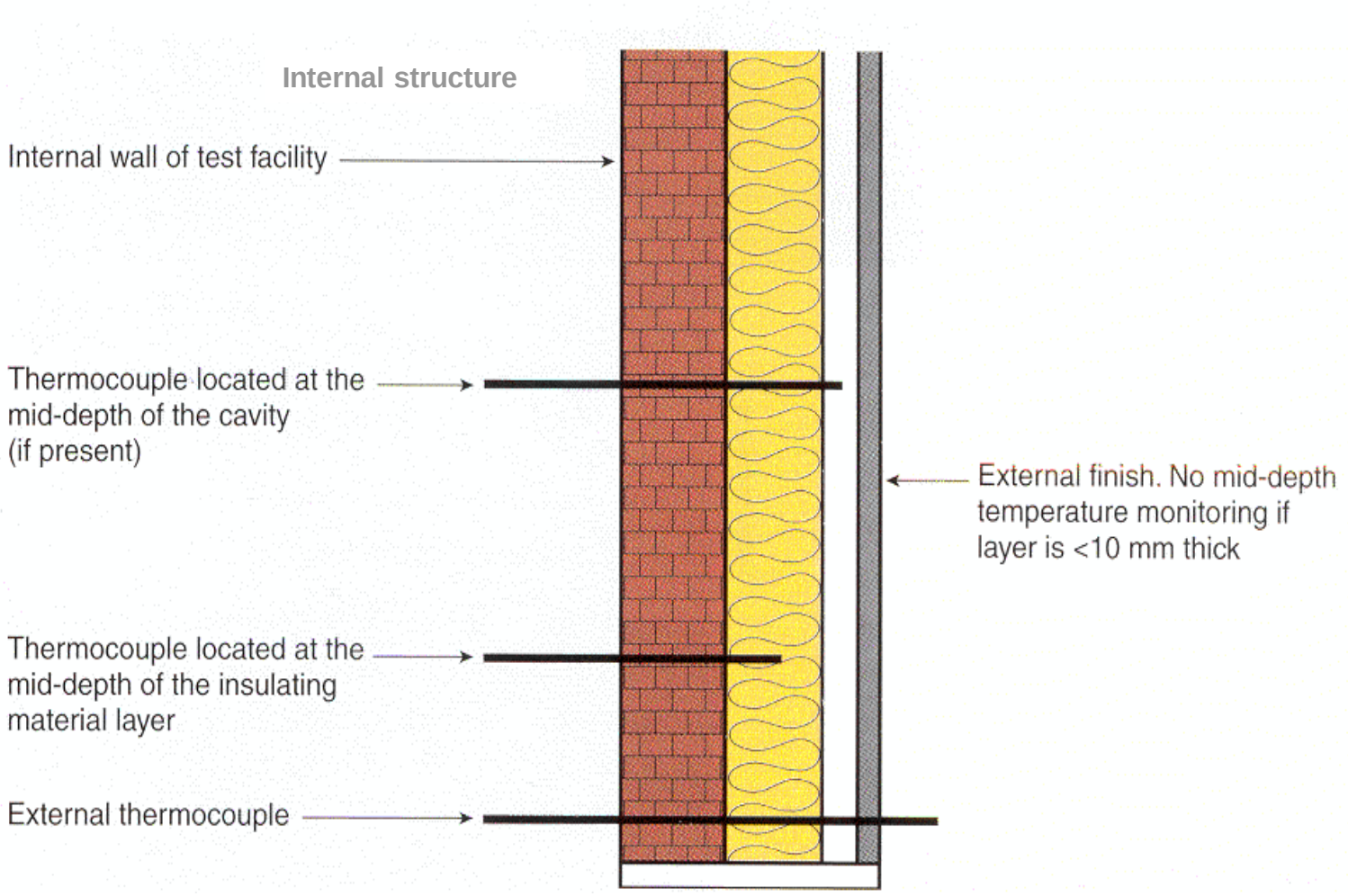

– Height of sample:

  6 m above chamber opening.
  Ground to full height on wing.

– Width:

  2.4 m main face.
  1.2 m wing.

# Location of Thermocouples

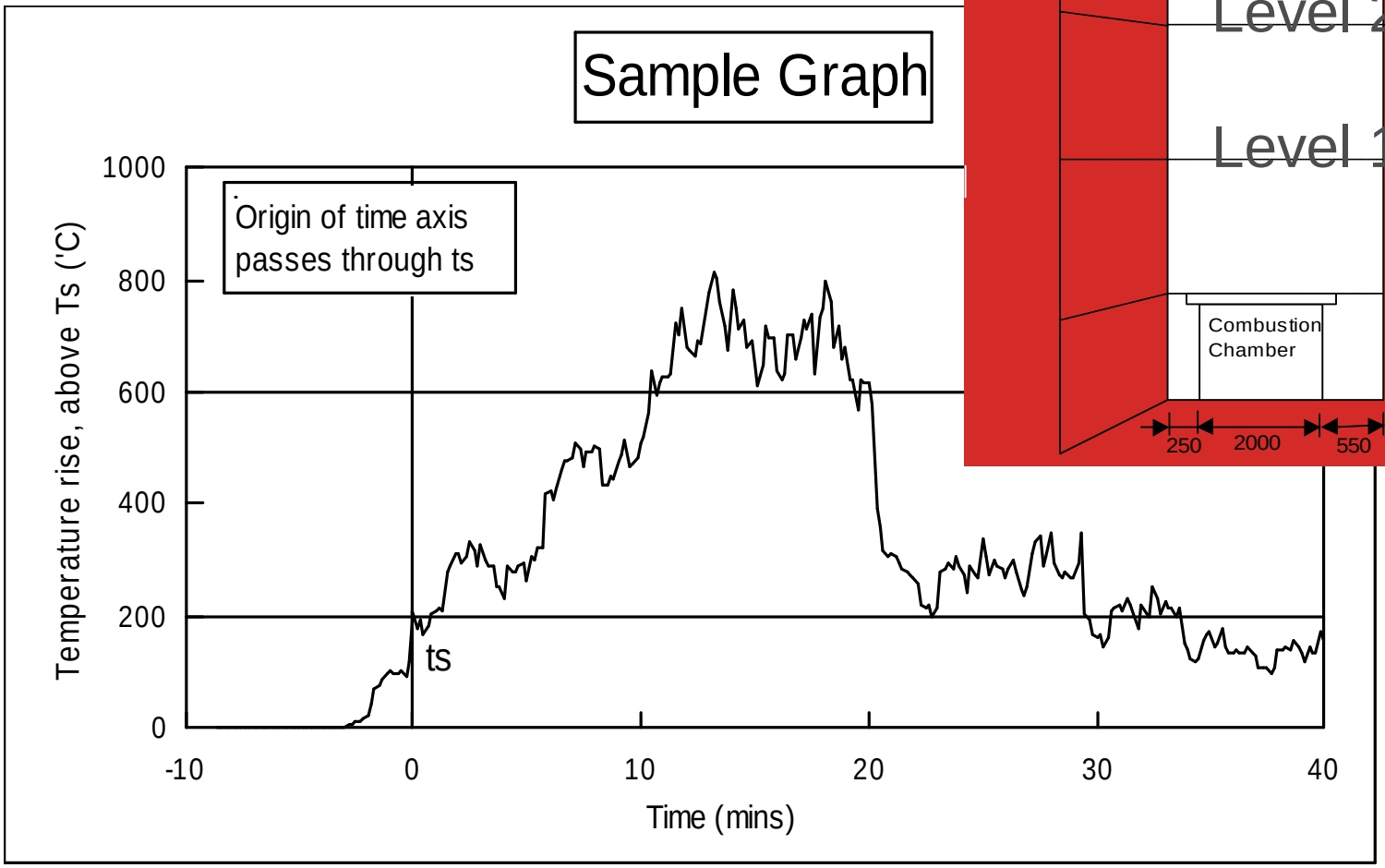


# Fullscale Test Video Clip

# 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

# Graphical Output

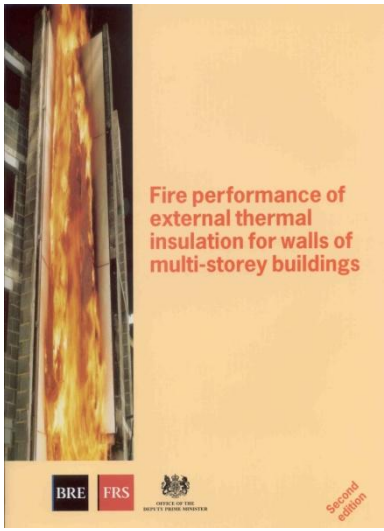


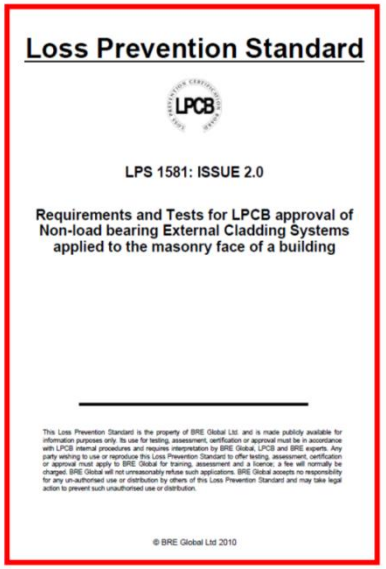
# Assessment of System Performance

Test method to assess whole system performance including fire breaks

# Classification of Performance

- The British Standards do not set performance criteria.
- Performance Classification is can be set by end users:
  - Examples include:
    - BR135 which sets performance limits used in UK Building Regulation guidance
    - LPS1581 which sets performance limits used for property protection applications



# Summary of the classification for a BS8141-2 system

- ***External fire spread***
- *Failure due to external fire spread is deemed to have occurred if the temperature rises above Ts of any of the external thermocouples at level 2 exceeds 600 °C, for a period of at least 30 seconds, within 15 minutes of the start time ts.*
- ***Internal fire spread***
- *Failure due to internal fire spread is deemed to have occurred if the temperature rise above Ts of any of the internal thermocouples at level 2 exceeds 600 °C, for a period of at least 30 seconds, within 15 minutes of the start time ts.*

# Summary of the classification for a BS8141-2 system

- ***Mechanical performance***
- *Details of any system burn through, collapse, spalling, delamination or flaming debris should be included in the test report. Whilst system collapse, spalling, delamination or flaming debris are not considered to be failure criteria, the nature of the failure should be considered as part of the overall risk assessment when specifying the system.*
- *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 60 seconds, 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 minutes of the start time ts.*

# Example of application - Building Regulations and Approved Document B in England and Wales

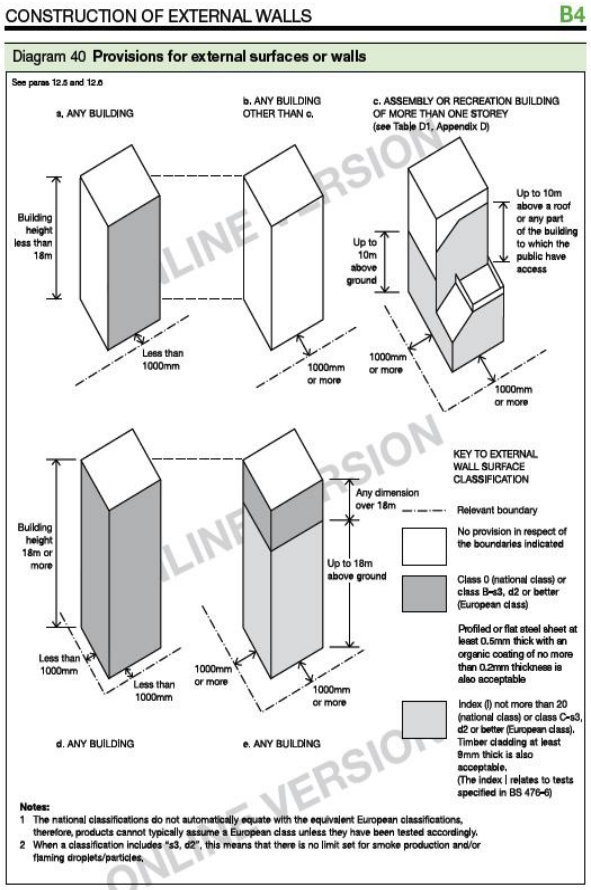
# Building Regulations (Fire Safety ) Guidance

- Approved Document B (ADB)
  - Two Volumes



Free to Download from :
www.planningportal.gov.uk/uploads/br/BR_PDF_ADB1_2006.pdf

Diagram 40, restricts the combustibility of external walls of high buildings.



CONSTRUCTION OF EXTERNAL WALLS B4

Diagram 40 **Provisions for external surfaces or walls**

See paras 12.5 and 12.6

a. ANY BUILDING

b. ANY BUILDING OTHER THAN c.

c. ASSEMBLY OR RECREATION BUILDING OF MORE THAN ONE STOREY (see Table D1, Appendix D)

Building height less than 18m

Less than 1000mm

1000mm or more

Up to 10m above ground

Up to 10m above a roof or any part of the building to which the public have access

1000mm or more

1000mm or more

Building height 18m or more

Less than 1000mm

Less than 1000mm

Any dimension over 18m

Up to 18m above ground

1000mm or more

1000mm or more

d. ANY BUILDING

e. ANY BUILDING

KEY TO EXTERNAL WALL SURFACE CLASSIFICATION

Relevant boundary

No provision in respect of the boundaries indicated

Class 0 (national class) or class B-s3, d2 or better (European class)

Profiled or flat steel sheet at least 0.5mm thick with an organic coating of no more than 0.2mm thickness is also acceptable

Index (I) not more than 20 (national class) or class C-s3, d2 or better (European class). Timber cladding at least 9mm thick is also acceptable.
(The index I relates to tests specified in BS 476-6)

**Notes:**

1 The national classifications do not automatically equate with the equivalent European classifications, therefore, products cannot typically assume a European class unless they have been tested accordingly.

2 When a classification includes "s3, d2", this means that there is no limit set for smoke production and/or flaming droplets/particles.

# External Walls over 18m in Height

A summary of Volume 2 Section 12 guidance based on components for Buildings Over 18m:

- External surfaces - Diagram 40
- All insulation and filler materials should be A2-s3,d2 or better (EN13501-1)

– OR

- Test the complete system to BS 8414 and classify in accordance with BR135

– And

- All cavity barriers and fire stopping guidance needs to be followed

# Example of Third party approvals for systems

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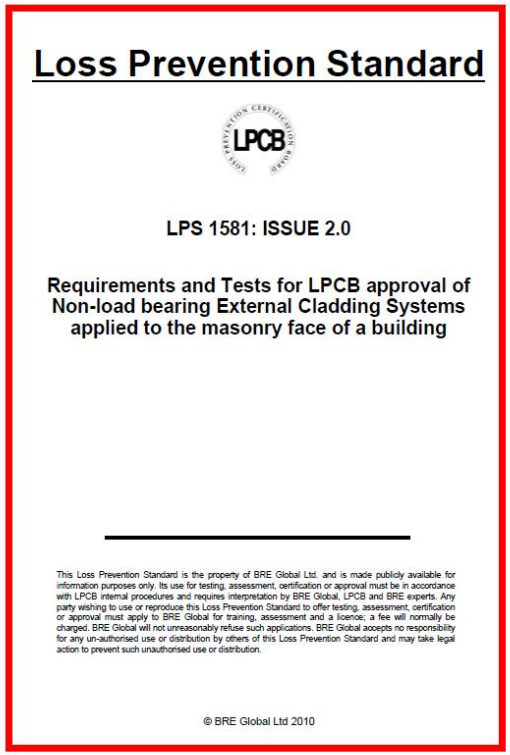
# LPCB Approval of External Cladding Systems

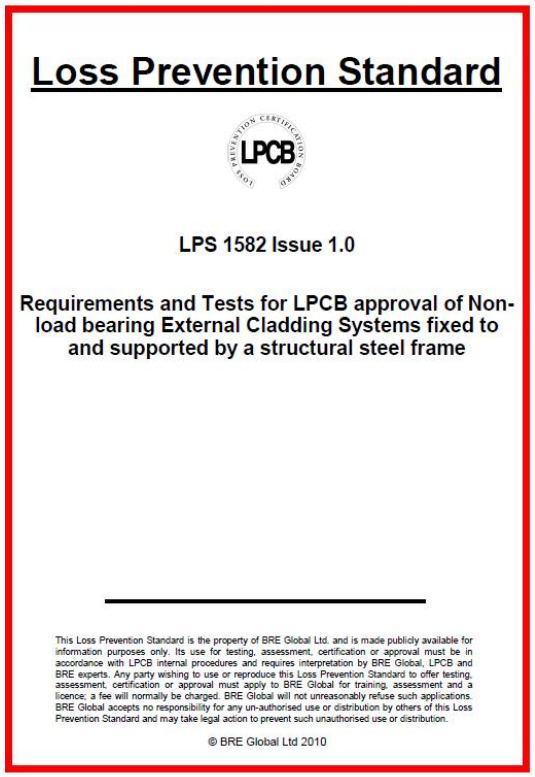


Loss Prevention Standard

LPS 1581: ISSUE 2.0

Requirements and Tests for LPCB approval of Non-load bearing External Cladding Systems applied to the masonry face of a building





Loss Prevention Standard

LPS 1582 Issue 1.0

Requirements and Tests for LPCB approval of Non-load bearing External Cladding Systems fixed to and supported by a structural steel frame



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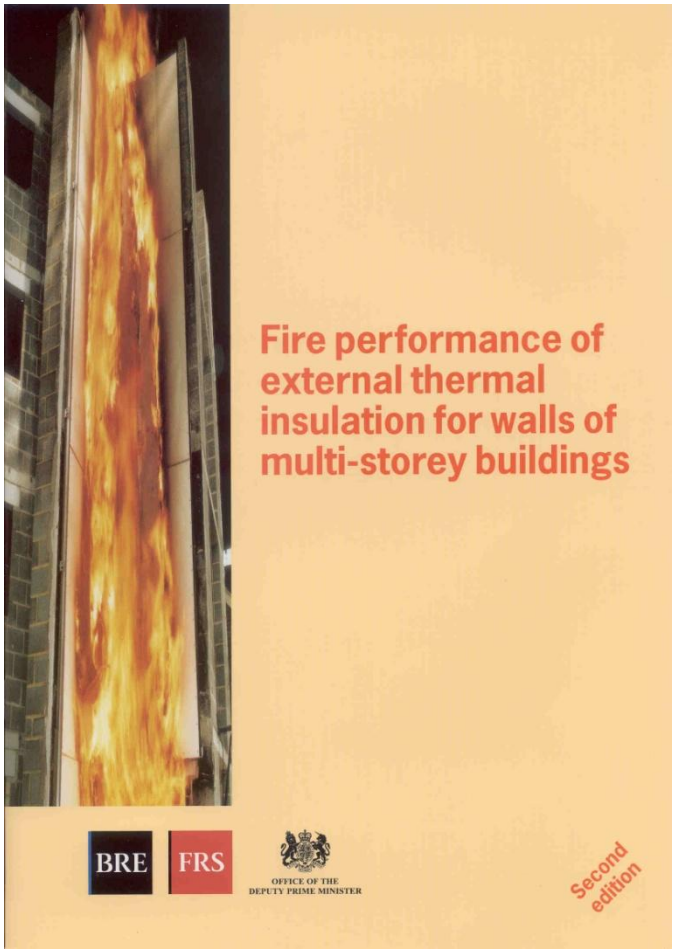
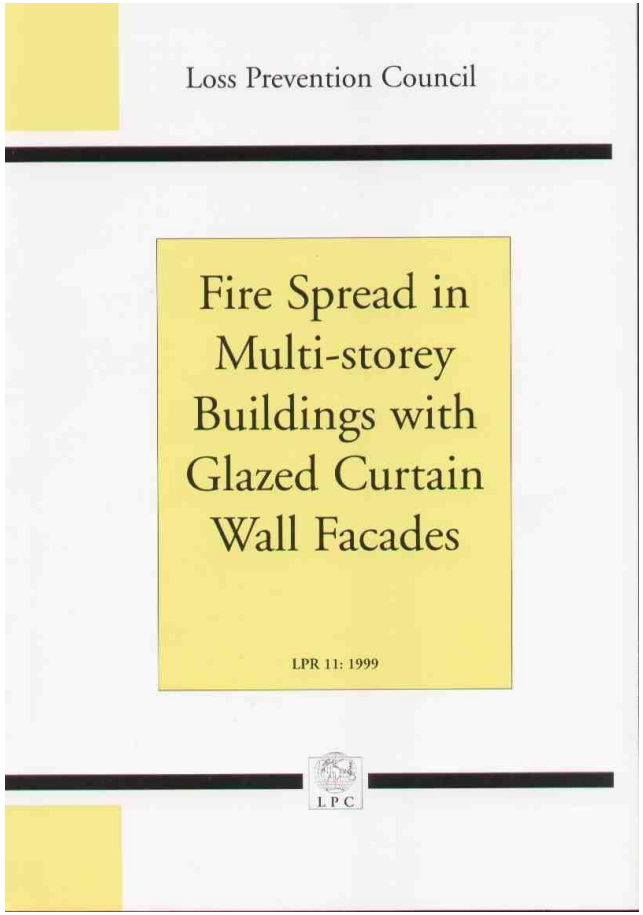
# Further Information


Fire performance of external thermal insulation for walls of multi-storey buildings
BRE
FRS
OFFICE OF THE DEPUTY PRIME MINISTER
Second edition


Loss Prevention Council
Fire Spread in Multi-storey Buildings with Glazed Curtain Wall Facades
LPR 11: 1999
LPC

# Thank you

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