Design Considerations

2.2 Fire Performance
Fire Performance

Fire considerations for construction have always been important and the Building Regulations reflect this. Following a fire within a multi-storey block of flats in Scotland (c.1999), the Building Regulations underwent review. Since then, attention has been focused on the spread of fire and the specific contribution of cladding systems.

Cladding systems and leap-frogging
One of the key mechanisms of fire spread described in the publication was fire ‘leap-frogging’ from window to window. This phenomenon quickly spreads fire upwards from the original source. When this happens, combustible cladding on the facade can ignite, fuelling the spread of fire. This process can continue with each additional window and storey, adding to the fire load.

The results of the publication’s findings set new regulations regarding cladding systems:

- Cladding specified on a multi-storey building must not ‘appreciably accelerate’ the rate at which fire will spread up the building.


Fire performance requirements are described in detail in the Building Regulations and associated Approved Documents. An overriding principle of fire management is one of containment. If a fire develops, it must not rapidly spread through the internal rooms or across the building facade.

The regulations are split into many parts when evaluating fire performance across the United Kingdom. The sections are listed here:

- For England and Wales certified systems must meet the requirements of Approved Documents (AD) B Volume 1, section B4 (domestic dwellings) or ADB Volume 2, section B4 (non domestic buildings).
- For Scotland Approved Document B4 applies (section 12) as does Part 2 (Fire) of the Technical Handbooks for domestic or non-domestic regulations.
- For Northern Ireland Technical Booklet E (Fire safety), section 4 applies.

External fire spread is covered under Approved Document part B4 of the Building Regulations (Part D10 in Scotland).
Testing cladding systems

Full scale fire testing takes cognisance of time, flame development, temperature and physical damage. Material choice is not the only consideration that needs to be thought through when testing. The design of the system itself can also affect the spread of flame.

Fire tests are conducted under strictly controlled conditions. A void is constructed at the base of the test rig. This is where the fire is initially lit and mimics an open window for the purposes of the test. Around this void, a complete multi-storey elevation is constructed from the test system. Observations are made throughout the test, but a key criterion is that the system remains attached. A pass or fail is awarded after a full examination of the test rig.

The majority of cladding systems are inevitably combustible to some degree. Cladding systems must allow enough time for the emergency services to evacuate inhabitants and gain control of the fire. How long the system withstands the fire is a key factor in the test.

England, Wales and Northern Ireland: Regulation B4 requires the external walls of a building to adequately “resist the spread of fire”. The functional requirements are given in the Approved Documents.

In any building1, the cladding system and materials must conform or exceed the regulation for limited combustibility2. Alternatively, the wall construction must meet the provisions of BR1354. External facing surfaces of buildings (<18m) must demonstrate compliance with British and European regulations for surface spread of flame. In Britain, Class 0 (BS476 parts 6/7) and in Europe, Euro Class B-S3, D2.

Scotland:
External cladding systems used above 18m must be completely non-combustible, or meet the provisions of BR135. These requirements also apply to any buildings which are less than 1m from a boundary, regardless of building height.

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1 Different regulations apply to buildings exceeding 18m in height and/or are less than 1m from a boundary.
2 Regulation B4 - Section 12, Approved Document. Limited combustibility is defined in Regulation B4, Appendix A, Table A7
3 BR135: ‘Fire performance of external thermal insulation for walls of multi-storey buildings’
Materials of limited combustibility
Expanded Polystyrene (EPS) is a thermoplastic insulation and will inevitably melt in a fire. It is vital that EPS of ‘limited combustibility’ is used. Sto only use high quality EPS incorporating a fire retardant, which does not contribute to the fire load. All insulating materials from Sto conform to Regulation B4 and are either non-combustible or of limited combustibility. When specifying EPS, full depth firebreaks are required to resist the progress of fire across the face of the building. This is an additional precautionary measure to further inhibit the spread of flame.

EPS systems can be tested on full-scale fire tests (BS 8414) to monitor the reaction to fire of the composite system. The system can only be specified for high rise projects if it meets the provisions of BR135 during testing.

Building Research Establishment (BRE) and Loss Prevention Standards (LPS)

BRE Global is an independent, third party approvals organisation offering certification of products and services. Their Loss Prevention Certification Board (LPCB) assesses and certifies fire systems against standards such as BS, EN and LPS. These standards were developed in co-operation with manufacturers and insurers. All approved systems are listed in the “Red Book”.

LPS 1581 – An LPCB standard for non-load-bearing external wall insulation and render fixed to a solid substrate. Fire testing follows the BS 8414 part 1 methodology.

LPS 1582 – An accredited third-party approval for non-load-bearing EWI with render applied to lightweight steel frame. Fire testing follows the BS 8414 part 2 methodology.

BR135 – A guidance document from the BRE providing performance criteria and a classification methodology, defined in BS 8414 Parts 1 and 2. It also includes guidance on the fire performance and design principles of EWI.

Formerly LPS 1181, part 4
BR135: ‘Fire performance of external thermal insulation for walls of multi-storey buildings’
Firebreaks are used to prevent the rapid progress of fire spreading up the outside of a multi-storey building unchecked. They act as non-combustible, time delay buffers between areas where combustible materials or cavities may exist.

Firebreaks are usually mineral fibre, a minimum of 100mm high and run the complete perimeter of a building. As part of the Sto system, standard 200mm Lamella boards are often used.

Normally, firebreaks must be fully adhered to ensure good bond and to act as a smoke/flame barrier. Exceptions to this will be on to sheathing boards with breather membranes. The mineral fibre firebreak is mounted on to secure adjustable stainless rails. In this scenario, it utilises an intumescent strip to block drainage holes in the event of fire.

Firebreaks should be installed at every floor level after the second storey and correspond with all vertical fire compartments. However, some Fire Officers may require breaks to be installed at every floor level.

The Building Regulations require the installation of cavity barriers at positions of compartment walls and floors. This stops the passage of fire via cavities created behind the insulation either by design or otherwise. This is also a requirement at window openings where cavities may allow fire up behind the back of the system.

Although systems that incorporate mineral fibre Insulation are non-combustible, cavity barriers may still be required if the insulation is spaced/shimmed from the wall, creating a cavity.

We must consider all the requirements for fire control on a building, including:

1. Continuous horizontal firebreaks are normally required after the 2nd storey/beginning of 3rd storey, and every storey thereafter.

2. Vertical firebreaks may be required to provide fire compartmentalisation between adjoining rooms. The requirement and location of these firebreaks should meet Fire Officer/Building Control specifications.

3. Cavity firebreaks are needed to close the cavity at all openings such as windows and doors. This is a requirement for mechanically fixed systems, where the method of fixing creates a cavity.
Dealing with Cavities
Possible solutions when detailing the closure of cavities could include:

- Window frames (dependent upon the window type and its position)
- Mineral fibre (Minimum 100mm thick)
- Timber (Minimum 38mm thick)
- Other proprietary cavity fire closures.

Vented Cavities
The use of firebreaks in vented cavities is even more important. Vented cavities create a ready chimney for fire to rapidly progress unhindered and unseen.

In vented cavity situations, there is often not one standard solution that fits all conditions. Usually the solutions will comprise of a combination of perforated stainless steel angles and intumescent strips.

System specific details for dealing with cavities and vented cavities are available on request.

Fixings
The BRE guide BR135\(^5\) recommends that mechanical fixings should be used to support the firebreak. The recommendation is for stainless steel fixings through the mesh to support the render.

It is important to note that metal fixings will act as a cold bridge on the surface. They may have a visual impact in certain weather conditions and as the façade ages.

The provision and specification of fixings required for Fire Safety will ultimately be decided by the Building Control Officer. Early consultation in the design process is therefore vital.

\(^{5}\) These are BRE guidance recommendations. This is one route to showing compliance. Other possible options to meet the requirements include physical testing.
Full Scale testing
Sto has invested heavily in full scale fire tests. This process ensures the supply of high quality systems that perform well in a fire situation. The result is a wealth of test information for use in specifying a proven system in relation to fire.

The individual BS 8414 test reports are also available from Sto along with calorific tests on each system component. Please contact our technical services department if you require this test data.

Glossary of Fire Testing Standards and Test Methods

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<td>BS 476 Part 6</td>
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<td>BS 8414 Part 1</td>
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<td>Reaction to fire tests. Ignition of building products subjected to direct impingement of flame. Single-flame source test.</td>
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<td>LPS 1581 Issue 2</td>
<td>Formerly LPS 1181 part 4, a Loss Prevention Certification Board (LPCB) third party accreditation standard for non-load-bearing external thermal insulation composite systems applied to a masonry based substrate.</td>
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<tr>
<td>LPS 1582 Issue 1</td>
<td>A Loss Prevention Certification Board (LPCB) third party accreditation standard covering non-load bearing external thermal insulated cladding systems with render finishes fixed to and supported by a structural steel frame.</td>
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