Fire safety in subframe solutions

Fire safety in aluminium rainscreen subframe solutions

Written by David Fraser – Business Unit Manager, Rainscreen Subframe Systems

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Introduction

The Building Safety Act 2022 and its ongoing impacts.

The regulatory landscape is continuously evolving when it comes to fire safety in buildings. Accompanying the Building Safety Act 2022 is a multi-year plan for publishing further secondary legislation. This additional legislation will continue the process of underpinning the new building safety regime, and see more of the recommendations implemented from *Building a Safer Future*, Dame Judith Hackitt's report.

There has been a lot of focus, justifiably, on what the Act means for higher-risk buildings. But it shouldn't be forgotten that there are provisions in the Act aimed at protecting people in (and around) buildings of all types and sizes, regardless of a building's height or its number of storeys.

When we talk about fire safety, therefore, we are really talking about something much broader that goes with it: culture change. That means improving standards in the design, construction and management of buildings; it also means greater accountability, transparency and competence.

Avoiding complacency in fire safety
Better standards of fire safety are a regular feature of conversations in the construction industry, and have been for some years now. That is to be welcomed, but we also need to guard against any feelings that, as an issue, it has now been 'dealt with'.

Other areas of design and specification are demanding equal, it not greater, attention from designers, specifiers and installers. Sustainability is one such area. As project teams look to understand that subject better and reduce the environmental impact of buildings, there is a risk of feeling as though fire safety is now 'understood' and the solutions are in place.

The desire remains to go beyond the minimum standards of fire safety set out in the Building Regulations, and specifiers are keen to see fully non-combustible solutions in facades. But holistic fire safety depends on more than non-combustibility alone, and the shifting regulatory landscape shows how any hints of complacency cannot afford to be let in.

We must all work together to ensure critical areas like fire safety and sustainability are given equal priority, with project-specific solutions.

The role of manufacturers in fire safety
Building product manufacturers are not immune from these sweeping changes. If anything, the new legislation is putting them at the heart of the building safety regime.

In time, a new National Construction Products Regulator (NCPR) will "oversee a more effective construction products regulatory regime, and lead and coordinate market surveillance and enforcement"[1].

Manufacturers have "a duty to place on the market a product that is safe and, where applicable, a product that provides the performance required of a safety-critical product"[2]. The information that manufacturers provide must therefore be accurate, verifiable, and in a format that can form part of a project's golden thread (where that legislation applies).

Liability for product manufacturers is increased under the new safety regime. At the same time, thanks to the introduction of the new gateways in the planning and building control approval processes, manufacturers must also be prepared to provide more detailed information to project teams about their solutions, much earlier in the project timeline.

This should ensure that the required performance is delivered in the finished building, and it places even greater emphasis on the need for collaboration between project teams and manufacturers.

The three 'S's of aluminium rainscreen subframes: focus on safety
It is against this backdrop that SFS is publishing three documents about aluminium rainscreen subframes, each looking at a different 'S' in detail. The other two documents in the series look at sustainability and strength; this document is about safety, and fire safety in particular.

Aluminium is the ideal all-round choice for rainscreen subframes, thanks to its qualities and performance in all three areas working together to offer a complete solution. While the separate documents focus on their own areas of performance, their arguments feed into, and overlap, with each other.

Download: Sustainability in aluminium rainscreen subframe solutions →
Download: The strengths of aluminium in rainscreen subframe solutions →

A key aspect of this fire safety document is looking at the availability of non-combustible alternatives to facade components currently listed as exempt from such requirements in the Building Regulations. We'll also conclude by looking at the technical support available to promote close working with project teams.

Before that, we will explore fire safety in the context of the minimum standards of the Building Regulations, and the performance of aluminium as a material.

[1] *https://www.gov.uk/guidance/the-building-safety-act#what-the-act-means-for-residents-of-higher-risk-buildings-and-homeowners*

[2] *https://www.constructionproducts.org.uk/publications/technical-and-regulatory/cpa-guidance-building-safety-act-2022-v1-august-2023/*

Building Regulations and non-combustible facade solutions

BS 9999:2017 Fire safety in the design, management and use of buildings. **Code of practice describes how "the design of buildings for fire safety relies upon an understanding of the sources of fire, materials and systems likely to be involved in fire, how people use buildings, and the likely spread of fire".**

It goes on to say that managing fire safety starts with "the initial design, which is intended both to minimise the incidence of fire and to ensure that, when a fire does occur, appropriate fire safety systems (including active, passive, and procedural systems) are in place and are fully functional."

Building Regulations as a minimum standard
The length and scope of BS 9999 (and even its counterpart for dwellings, BS 9991) helps to explain why the total management of fire safety in buildings cannot be fully addressed within the technical guidance (i.e., Approved Documents) to the Building Regulations.

The Building Regulations are a set of requirements that buildings have to meet to be considered compliant. Their accompanying technical guidance offers one way by which buildings can achieve compliance – and includes reference to other relevant standards – but project teams are free to pursue other routes.

As the size and complexity of buildings grows, so more specialised guidance is required to provide the necessary levels of fire safety. Approved Document B volume 2 typically references BS 9999 when the requirements of specific building types go beyond the scope of the technical guidance provided.

In recognition of the Building Regulations being only a minimum standard of performance to achieve, project teams now routinely look to go beyond that.

Reasons for doing so include: it being appropriate for the project in question due to complexity; as a 'belt and braces' approach to limit liability; or because a higher standard of performance is required by insurers, usually to factor in property preservation.

What is the regulatory requirement for external fire spread?
Requirement B4 of Approved Document B says, "the external walls of the building shall adequately resist the spread of fire over walls and from one building to another having regard to the height, use and position of the building"[3].

In the context of the updates made to the Building Regulations in recent years from a fire safety perspective, the first significant changes were in November 2018. Among the steps taken was implementing a ban on the use of combustible materials in the external walls of certain high-rise buildings.

As part of that ban, Regulation 7 – which deals with fitness of purpose of materials and workmanship – was updated and expanded. It requires materials forming part of an external wall to achieve a European Classification of A1 or A2-s1,d0, both being a measure of non-combustibility. It then goes on, in paragraph 3, to give a list of materials and components that do not have to achieve that classification.

In technical guidance by the Centre for Window and Cladding Technology (CWCT) and the Society of Façade Engineering (SFE), it says, "the exemptions given by regulation 7(3) recognise the vital role that certain combustible materials presently play in the performance of modern facades, particularly in terms of thermal performance and weathertightness."

"However, the exemptions do not fully recognise the complexity of modern building envelopes and leave some ambiguity and uncertainty over materials which may or may not be used, and in what circumstances they may be used"[4].

Going beyond the minimum standard for external fire spread
The technical guidance reflects on how the government's ambition is to reduce the list of exemptions over time, and that the list could therefore also change at any time.

Designers and specifiers seeking to work with the updated regulations may or may not be aware of that ambition. Regardless, they also want to limit their own liability and seek the best possible fire performance they can achieve.

To that end, ever since the regulation was expanded and the list of exemptions made, people have sought non-combustible alternatives to components that could legitimately use combustible material.

As the CWCT and SFE document say, "wherever there is suitable non-combustible material available, it will almost always be appropriate to use it in preference to a more combustible alternative which achieves the same performance in other regards."

The result of this is both an expectation and an imperative on manufacturers to develop alternative non-combustible solutions for currently-exempt components.

How does the list of exemptions apply to rainscreen subframe solutions?
To accord with the regulatory requirement, the core material of a rainscreen subframe system installed on a 'relevant building' needs to be non-combustible.

Included on the list of exemptions, however, is: "thermal break materials where the inclusion of the materials is necessary to meet the thermal bridging requirements of Part L."

Like all metals, aluminium is a very efficient conductor of heat. To help reduce the heat loss through a subframe, it is common to include a thermal break pad. The pad 'decouples' the metal subframe from the structure, reducing the flow of heat energy through it and helping to achieve lower U-values without substantially increasing the thickness of the insulation used in the system.

Maximising the thermal performance of building envelope system is a significant focus at SFS, and you may wish to read this whitepaper in conjunction with other whitepapers we have produced.

Download: The effects of rainscreen subframe systems on the thermal performance of external walls →
Download: The effects of thicker insulation in rainscreen cladding subframe systems →

The role of the thermal break pad is an excellent example of the kind of ambiguity that the CWCT and SFE referred to in their technical guidance. If a U-value can be achieved without the thermal break – even if it massively increases the weight, cost and thickness of the whole facade system to achieve it – then is the thermal break "necessary"?

Little wonder, then, that specifiers are keen to use a non-combustible thermal break material if possible, even where a combustible version is deemed compliant. We'll return to this subject at the end of the document, after we have looked at the fire performance of aluminium and how it behaves in the event of a fire.

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[4] *https://cdn.shopify.com/s/files/1/0192/5660/6786/files/CWCT_SFE_fire_guidance_Issue01_September2020.pdf?v=1679586705*

What is the fire performance of aluminium?

At the start of the previous section, we quoted BS 9999:2017's definition of fire safety. In isolation, the definition makes complete sense – but we all know there can be significant gaps between theory and practice.

The number of materials and components in any given facade build-up is incredibly complex, and the interaction of the facade with other parts of the building only adds further complexity. By themselves, specifiers can't be expected to predict and fully understand exactly how the build-up they choose is likely to perform in terms of fire.

However, manufacturers can help specifiers to make more informed decisions by providing useful foundational information. In that spirit, this section looks at aluminium as a material for rainscreen subframes, and lays some of the groundwork to understanding how it supports wider fire safety.

Aluminium requires no reaction to fire testing
Reaction to fire testing establishes the behaviour of products when they are exposed to heat and fire, and how they contribute to a fire as they decompose due to that exposure. Characteristics assessed include how easily the product ignites, whether it burns, and its calorific value.

Using results from individual tests allows a product's reaction to fire to be classified in accordance with EN 13501-1:2018 *Fire classification of construction products and building elements. Classification using data from reaction to fire tests.*

From best performing to worst performing, a product can be classified A1, A2, B, C, D, E or F. Materials classified as A1 and A2 are non-combustible materials.

For some materials, their reaction to fire is a known quantity. Their low level of combustibility allows them to be automatically classified as A1, as per Commission Decision 96/603/EC which states: "For the purpose of this classification, no reaction-to-fire testing of those materials and products made from them shall be required".[5]

The list of materials given includes aluminium and aluminium alloys. Despite this, it is still common to receive technical enquiries asking for proof of aluminium's non-combustibility. But while an A1 classification might seem the be-all and end-all of aluminium's fire performance, it is really only the starting point.

How does aluminium behave in a fire?
Compared to other metals, aluminium starts to lose integrity at a relatively low temperature of around 600 to 650°C. Temperatures in a building fire can far exceed this, which might seem like an issue at first glance. When the material reaches that kind of temperature, it goes plastic.

Crucially, what aluminium *doesn't* do is contribute to spread of flame, which is a critical aspect of fire safety. Because aluminium has little to no calorific value, it doesn't add to the fuel load of the fire. The materials and components used around it, of course, are a different matter.

Something that people might not consider relevant to fire safety is aluminium's thermal conductivity. From an energy efficiency perspective, the high thermal conductivity of metals like aluminium leads to higher rates of heat loss. But in a fire, conductivity is actually helpful for dissipating heat away from the fire source, reducing the intensity of heat build-up locally. These performance characteristics do not vary with different alloys of aluminium.

Some people learn about the low melting point of the material and see it as a pitfall, without appreciating the positive elements that result from the material's other properties. That's why this document is part of a series, to provide the widest possible overview of aluminium and its benefits.

System testing of facade build-ups
Understanding more about the behaviour of aluminium doesn't give specifiers information about the products and materials used with the subframe.

Where reaction to fire behaviour relates to individual components, the only way to assess fire resistance – resistance to collapse, fire penetration (integrity), and transfer of excessive heat (insulation) – is looking at build-ups as a whole.

Large-scale system testing in accordance with BS 8414 demonstrates how fire is likely to spread across or within an external cladding system. An external wall build-up can then be classified in accordance with BRE report 135 *Fire performance of external thermal insulation for walls of multi-storey buildings.*

BS 9414 sets out how to evaluate variations and changes to products and systems which have been tested in accordance with BS 8414.

What does the introduction of gateways mean for construction projects?
The new building safety regime has introduced three new 'gateways' into the project approval process. The first is before planning permission is awarded; we are particularly interested in the second and third gateways, which apply to Building Regulation compliance.

Gateway Two is before construction starts, and work can only begin on site once building control approval is received. Gateway Three is before handover, and a building can only be occupied once the necessary information has been provided and a completion certificate has been issued.

If significant changes are made to an application approved at Gateway Two, all work on the project must stop and the proposals reassessed. The minimum timeframe for reassessment is six weeks, so project teams will seek to avoid specification changes wherever possible. All of this increases the need for certainty in wall build-ups to avoid adding time and cost to projects.

More design work is now required in the early stages of projects, favouring greater involvement from manufacturers and making it more important to collaborate with manufacturers who are prepared for – and can fully support – this new way of working.

Early engagement is something that SFS has championed for a long time, and we have a whole series of whitepapers looking at the subject, including how to get more early engagement, and one specifically about fire safety.

Read More: Robust Building Envelope Specifications – Paper 1: Are we failing to plan or planning to fail? →

[5] *https://uk.sfs.com/content/files/7082%20-%20UK/Downloads%20PDFs/NVELOPE/Fire%20Safety%20-%20EC_Decision_96_603_EC.pdf*

Conclusion

No such thing as 'fireproof'
Correct and appropriate use of terminology is essential when it comes to fire safety. Recognising when reaction to fire and fire resistance are relevant characteristics is fundamental to the understanding required to design safer buildings.

The construction industry is rightfully moving away from terms like 'fireproof', and there is no such thing as a 'fireproof' building.

'Fire ratings' themselves, as important as they are, are only one part of the jigsaw. Designing for fire safety is how you get people out of the building quickly and safely, and how you give the emergency services the opportunity to bring fires under control before they get out of hand.

Supporting specifiers to design for fire safety
For specifiers, it's a question of choosing the right materials to balance fire safety requirements with cost, as well as sustainability impact. But it's also incredibly difficult to factor in the different performance properties of different materials and components.

By itself, aluminium helps to achieve that balance in rainscreen subframe systems. But an aluminium subframe does not make for a fire safe building alone, and the complexity inherent to specifications is why manufacturer technical support is so essential.

The support that manufacturers can offer is arguably of most importance when it comes to ancillary products and their performance – even those on the exempt list of Regulation 7.

Introducing SFS's A2 thermal break pad
In-keeping with the desire to see manufacturers offer non-combustible alternatives to exempt ancillary components, SFS has worked hard to develop a thermal break pad that achieves a reaction to fire classification of A2.

By evolving our Thermal Pad to support the performance goals of specifiers, as well as broader industry goals to innovate better solutions, we can now offer additional reassurance alongside the proven performance of aluminium subframes.

The new Thermal Pad has been independently tested by Warringtonfire and classified in accordance with EN 13501-1. It is an evolution of the technology used to create the original Thermal Pad, so offers the exact same thermal performance – but with the small combustible element removed for extra peace of mind.
Alongside the new product innovation, SFS continues to offer comprehensive technical support to support building regulation compliance and designing for fire safety. For example, we commonly support industry partners with full scale BS 8414 tests where needed.

Specifiers and installers, including those working within the new building safety regime and submitting information at the designated Gateways, can take advantage of our **SFS ConnectSuite® Project Builder tool** →. The free online service allows users to submit the requirements of their rainscreen cladding projects, and our technical team tailors a project-specific subframe solution.

Combining a Project Builder output in the early stages of a project, with the non-combustible Thermal Pad, can help to meet the information requirements of the building safety regime, contribute to designing fire safe buildings – and play a vital role in changing culture within construction for the better.

E: ukenquiries@sfs.com
W: uk.sfs.com
T: (0)330 0555 888

Contributors:
Paul Forrester

SFS Group Fastening Technology Ltd.
Division Construction
153 Kirkstall Road
Leeds, LS4 2AT
ukenquiries@sfs.com
www.uk.sfs.com