SUPPLEMENTARY INFORMATION

Cladding for surveyors

Supplementary information paper to *Valuation of properties in multi-storey, multi-occupancy residential buildings,* RICS guidance note

UK

1st edition, March 2021

RICS

CLADDING FOR SURVEYORS

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Contents

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Glossary

Aluminium Composite Material (ACM)	ACM is a thin, three-layer sandwich panel consisting of two pre-coated aluminium sheets bonded to a structural core that is often polyethylene (PE). ACM has been divided into three categories through MHCLG screening tests. Refer to **Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings** for further details. ACM with an unmodified polyethylene (PE) core is likely to be category 3 material and is highly combustible.
Approved Document B (ADB) (England only) **Building Standards Technical Handbook 2019: Domestic (Scotland only)** **Approved Document B Wales (ADB Wales) (Wales only)** **Building Regulations (Northern Ireland) 2012 Guidance: Technical Booklets – Particularly Technical Booklets B and E (NI only)**	ADB (in two volumes) contains statutory guidance on fire safety, including means of escape, fire spread, structural fire protection and fire service access. Volume 1 covers dwellings (including flats) and Volume 2 covers buildings other than dwellings. Note: Applicable in England only. Those working on property in Scotland, Wales or Northern Ireland should refer to the local equivalents, as listed.
Assessor	The person who completes the EWS1 form and who is a fully qualified member of a relevant professional body within the construction industry. They must possess sufficient expertise to identify the key materials within the external wall cladding system.
British Standards (BS)	The standards produced by the British Standards Institution (BSI). BSI is the UK's national standards body (NSB), responsible for the UK publication, in English, of international and European standards.
BS 8414-1:2020	British Standard on fire performance of external cladding systems – Test method for non-loadbearing external cladding systems fixed to, and supported by, a masonry substrate.

BS 8414-2:2020	British standard on fire performance of external cladding systems – test method for non-loadbearing external cladding systems fixed to, and supported by, a structural steel frame.
Cavity barriers	Typically elements of fire-resistant materials which are fitted within building cavities typically horizontally or vertically to assist in preventing fire spread within cavities. Cavity barriers typically are only recommended to provide 30 minutes integrity and 15 minutes insulation.
Compartmentation	Fire compartmentation is an element of passive fire protection to inhibit fire spread within the building. This is achieved by dividing the premises into 'fire compartments' using fire doors, floors and walls of fire-resisting construction, cavity barriers within roof voids and fire stopping to services which penetrate through these elements.
Curtain wall	An external covering of a building in which the outer walls are non-structural, used only to keep the weather out and the occupants in a safe and controlled environment. It is usually a prefabricated system made of relatively lightweight materials, fixed directly to the structure.
Expanded, closed cell Polystyrene (EPS)	Beads of polystyrene foam, heated to cause them to expand and fuse together into rigid closed cells.
Euroclass system	Determines the fire performance of any product by measuring a comprehensive set of characteristics, including ignitability, flame spread, heat release, smoke production and propensity for producing flaming droplets/particles. BS EN 13501-1 categorises products into one of seven classes of reaction to fire, ranging from A1 (non-combustible) down to F (the worst performing class in terms of combustibility), using defined tests or combination of tests.
European Standard(sometimes referred to as a Euro Norm or EN)	An international technical standard for a wide variety of commercial and industrial activities that has been recognised as applicable in the European Union. The organisations recognised by EU regulations to establish standards include CEN, CENELEC and ETSI.
External wall insulation system (EWIS)	A non-load bearing cladding systems that provides exterior walls with an insulated, water-resistant, finished surface in an integrated composite material system widely used to retrofit residential buildings, improving their thermal performance.

External wall system (EWS)	All the materials within external walls, and includes insulation, various coverings and related fixtures and fittings with the purpose of providing protection to the building structure and the occupants from the elements while providing aesthetic benefits.
EWS1	The form to be completed by an assessor, used by lenders to make a decision on lending for secured lending purposes on multi-occupied residential buildings (not houses or bungalows).
Fire-stop	A form of passive fire protection that is used to seal around openings and between joints in a fire-rated wall or floor assembly. Fire-stops are designed to maintain the fire resistance of a wall or floor assembly to impede the propagation of fire and smoke. Fire barriers are typically recommended to have a fire resistance rating of more than 60 minutes of integrity and insulation.
Fire-rated or fire retardant (FR)	Having the ability or tendency to slow up or halt the spread of fire. Does not mean fire resistant.
Fire risk appraisal and assessment (FRAA)	As required by BSI PAS 9980 *Fire risk appraisal and assessment of external wall construction and cladding of existing blocks of flats – Code of Practice*.
Fire risk assessment (FRA)	Assessment of the premises to identify measures to prevent fire and keep people safe, as set out in the Regulatory Reform (Fire Safety) Order 2005 which requires that the occupier completes a fire risk assessment.
Glass Reinforced Cement/ Concrete (GRC)	A type of fibre-reinforced concrete mainly used in exterior building façade panels and as architectural precast concrete.
Glass Reinforced Plastic (GRP)	A composite material that consists of a polymer matrix reinforced with glass fibres.
High pressure laminate (HPL)	Cladding material made from resin- impregnated paper, manufactured under high pressure into sheets.
Metal Composite Material (MCM)	A thin, typically 3-5mm, three-layer panel consisting of two pre-coated metal (copper, zinc, etc) sheets bonded to a structural core that is often polyethylene (PE) or mineral. ACM is a type of MCM.

MHCLG advice notes	A series of advice notes published by the UK government MHCLG post Grenfell. These cover guidance on composite doorsets to advice notes on balconies and interim mitigation measures required pending cladding remediation. Advice notes have since been superseded in January 2020 by the **Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings**, often referred to as 'the consolidated advice note'.
Mineral wool insulation	Non-organic fibrous material formed by spinning or drawing molten mineral or rock materials such as slag and ceramics. It has excellent thermal properties and is therefore used extensively in wall systems.
Polyisocyanurate (PIR) and polyurethane (PUR) insulation	These are thermoset plastics typically produced as a foam and used as rigid thermal insulation in wall systems and in brick cavities because of their high insulation properties.
Polytetrafluoroethylene (PTFE)	Polytetrafluoroethylene fabric and materials.
Polyvinyl butyral (PVB)	A film that bonds two glass panes under heat and pressure to form laminated safety glass.
Rainscreen cladding	An exterior, lightweight wall construction where the cladding stands off from a backing wall, with a cavity or air barrier to allow drainage and evaporation of moisture within the system. It does not control the internal environment.
Valuer	An individual, group of individuals, or individual within an entity (whether employed or engaged) possessing the necessary qualifications, ability and experience to undertake a valuation in an objective, unbiased and competent manner. In some jurisdictions, licensing is required before one can act as a valuer.

1 Introduction

This supplementary information paper has been produced to support **Valuation of properties in multi-storey, multi-occupancy residential buildings**, RICS guidance note.

This document has been produced to increase surveyors' knowledge of typical external wall cladding systems for building types that may be considered in the 'External Wall Fire Review' process – otherwise known as 'EWS1' due to the name of the form used – through providing illustrated descriptions of typical cladding systems to assist in identification.

It should be appreciated that there are many factors beyond cladding that influence fire safety in buildings, for example:

- compartmentation
- means of escape
- detection and alarm systems
- automatic fire suppression systems including sprinklers
- occupant behaviour, and so on.

All of these can contribute significantly to life safety risk. These would typically be considered in the buildings' Fire risk assessment (FRA). However, as demonstrated by the Grenfell Tower fire, external wall cladding systems are an important factor in the holistic fire safety of a building. The external wall system fire risk appraisal and assessment (FRAA) informs the FRA.

The document covers only the main types of external wall systems and balconies found on residential blocks of flats in the UK (so does not include houses/bungalows, commercial and non-domestic buildings, although some of the cladding systems presented may be found on these building types).

It also provides some relevant background to the complex fire safety landscape that has developed since the Grenfell Tower fire in 2017, and how the EWS1 assessment system was developed.

2 Background to EWS1

2.1 Background to fire safety issues following the Grenfell Tower fire

Following the Grenfell Tower tragedy in 2017, fire safety in our built environment has rightly been under significant scrutiny both in the UK and globally. As details surrounding the fire were gradually clarified, it became apparent that the building's cladding system, comprising aluminium composite material (ACM) cladding, combustible insulation, cavity barriers, etc., was a significant factor in how the fire spread so rapidly across the external walls of the building.

Due to the perceived risk in some high rise buildings with ACM cladding, the government in England, through what was then the Department for Communities and Local Government's (now the Ministry of Housing, Communities & Local Government (MHCLG)) **Building Safety Programme**, ordered testing of ACM cladding samples taken from high rise residential buildings. It was later revealed that at least 455 buildings over 18m in England alone had unsafe ACM external wall cladding unlikely to meet the Building Regulations, consequently posing an unacceptable fire risk.

Similar initiatives were established in devolved administrations across the UK, with The Independent Reference Group set up in Northern Ireland and The Building Safety Expert Group in Wales. The Ministerial Working Group on Building and Fire Safety was established in 2017 to oversee reviews of fire safety frameworks in Scotland, where **51 high-rise residential buildings** were found to have ACM cladding. However, across the UK, the most problematic high-rise residential buildings are found in England.

Through **MHCLG advice notes**, the government in England confirmed that all unsafe ACM cladding systems with an unmodified PE filler (category 3) should be stripped from these high-rise buildings, whether in public or private ownership. The cost of replacing the ACM cladding was revealed to be significant and, in the hope of expediting the cladding replacement through easing the financial burden on owners, the government set up Social Sector and Private ACM cladding replacement funds. However, replacing such cladding systems is a complex process requiring significant time and resources, as well as competent professionals and contractors to plan and execute the work. This process also highlighted a skills gap in industry, revealing that such professionals and contractors with the correct Professional Indemnity Insurance (PII) were in short supply.

This process has been fraught with other hinderances, including, for example, a tightening of the PII market around fire safety as the financial risk to insurers became apparent. As a result, replacing ACM cladding has been a frustratingly slow process and, as of end of October 2020, only **79% of the buildings over 18m** with dangerous ACM have had the cladding either removed or are in the process of doing so.

As investigations progressed throughout the industry, it became clear that non-ACM forms of cladding such as high pressure laminate (HPL) may also present a significant fire hazard. This risk was made clear through the occurrence of significant new fire events, including a sub-18m student accommodation building in Bolton catching fire in November 2019, later found to be clad with HPL panels. Subsequent tests commissioned by MHCLG showed that the fire risk depends upon the type of HPL and insulation.

To create clarity on their requirements, MHCLG issued several advice notes for building owners on managing the risks of external wall systems including potentially combustible material on tall buildings over 18m in England. Released in December 2018, MHCLG Advice Note 14 in particular addressed non-ACM cladding, while a later un-numbered and undated advice note (later listed as Advice Note 21) addressed issues with balconies, which was released following a residential fire in Barking in June 2019 where timber balconies were found to be a significant contributor to the fire spread.

In June 2020, to address the additional cost of removing dangerous non-ACM cladding the UK government made a further non-ACM remediation fund of £1 billion available to owners of residential buildings over 18m with non-ACM forms of cladding, such as HPL, timber and other Euroclass C/D cladding types. In February 2021 it was announced that this fund will be topped up by a further £3.5 billion.

Devolved powers in Ireland, Scotland and Wales have not created similar funds at the time of publishing, leaving remediation to local authorities and private owners. Nonetheless, the ongoing industry and government-led investigations into fire safety in the UK have now revealed that combustible cladding is only one component of a complex, industry-wide, fire safety problem revealed following the Grenfell Tower fire.

The UK government has now placed a ban on combustible external wall system materials on new high-rise residential buildings of over 18m in England, implemented through the **Building (Amendment) Regulations 2018** (laid on 29 November 2018). The regulations came into force on 21 December 2018 with a two-month transitional period. The government committed to reviewing the effectiveness of the ban after one year. In January 2020, the government launched a consultation on proposed amendments to the ban. Buildings completed after this date may not have been constructed in accordance with the ban if they were started before the new rules applied.

The ban does not apply to existing buildings where no building work is being carried out. In these instances a case-by-case risk-based approach to fire safety in existing buildings is most appropriate in line with the advice already issued by MHCLG and their Independent Expert Advisory Panel.

2.2 Issues in the mortgage market

By mid-January 2018, the financial industry started to see mortgage lenders refusing to lend on properties with such fire risks unless the wall system was confirmed to be safe, due to uncertainties surrounding the safety of external wall systems and the potentially significant costs of remediation. This risk is identified to the lender through the mortgage valuation process, whereby a valuer will assign a 'zero-value' to the property if the cladding poses – or may potentially pose – a significant fire risk that may give rise to the need for remediation and should therefore be alerted to the lender. This does not mean the property has no value, but alerts the lender to this risk and allows them to factor this into their decision on lending. Ultimately, this has meant that owners of property in high-rise residential buildings have become increasingly unable to sell or re-mortgage their units, resulting in additional frustration and concern for owners living in these types of buildings.

The challenge lies in the fact that the normal inspection that forms part of a mortgage valuation (or where applicable, a Home Report in Scotland) is not sufficient to establish whether or not a wall system contains combustible materials, or was built in a manner which facilitated the spread of fire and therefore requires remediation. The reason for this is that the mortgage valuation and home survey process is, rightly, predicated on reliance that compliance with the statutory building regulations regime provides assurance, among other matters, around hidden parts of buildings. However, since Grenfell, it has become apparent that an alternative process with better governance is required. High-rise buildings, despite having the relevant and necessary Building Regulation certification (or certification from an Approved Inspector and a warranty from a private sector provider), are routinely found to require remediation works, often including complete wall system removal. This may have a significant impact on the value of a property, where those costs would be passed onto mortgagees. Note that a Building Control final certificate does not guarantee that a building complies with the building regulations or is defect free. This is not the role of the Building Control Body (BCB) or warranty body.

Following discussions on how to address this problem with MHCLG and other industry stakeholders, including UK Finance and the Building Societies Association (BSA), industry took the decision to create a system for retrospectively inspecting existing cladding in residential buildings over 18m. The intention of this system is to aid valuers and lenders when they are asked to value a building that may have combustible cladding, but this is outside their expertise. With this process, the valuer can request a retrospective inspection of the external wall system to be undertaken by competent experts.

The findings of this inspection should then enable the valuer to be better informed for the valuation process, as well as for the lender, to the presence or otherwise of combustible cladding needing remediation. The intended result of this system of inspection is that properties which have cladding not likely to require removal can then proceed along the lending process, thereby easing up some of the associated problems in the mortgage market and in the supply chain that delivers remediation to the really high risk buildings, in order that the scarce resource can go to the highest risk buildings. The name for this system was called **The External Wall Fire Review**, to be presented through a form termed EWS1.

2.3 EWS1 and changes to MHCLG advice

The proposed retrospective cladding inspection process was developed in consultation with a range of market participants including UK Finance, BSA, lenders, chartered engineers registered by the IFE, developers, managing agents, building owners, chartered valuation surveyors, legal representation and professional indemnity insurance representation. EWS1 was the outcome of this cross-industry effort and designed as a means of enabling competent fire experts to assess whether remedial works are required, in a simple and clear pro-forma, from which lenders and valuers can assess whether remedial works affecting value exist. This allows lenders and valuers to provide the best advice to those wishing to access finance and make purchasing decisions. The process has logically followed the path of requiring the building owner to obtain the EWS1 form for buildings in scope, which is then provided to valuers and lenders.

It is important to be clear on the issue the EWS1 was designed to address: to provide a process whereby the external wall system could be assessed in residential blocks of flats by a competent person. This would then provide accurate information to the valuer and support high quality valuation advice and informed lending decisions for consumers wishing to access finance. The process does not seek to address the available capacity of competent experts to complete the form (where there is a significant backlog of complex cases exacerbated by the PII market issues). The EWS1 form is not intended to be a life safety certificate nor a fire risk assessment, and should not be relied upon as either. It is produced purely for lenders and valuers determination of remedial works affecting value.

The form was launched by RICS, BSA and UK Finance in December 2019.

However, in January 2020 MHCLG launched the 'Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings', often referred to as 'the consolidated advice note' (or CAN) since it superseded all previous advice notes into one document. Unknown at the time of publishing the EWS1 protocol, was new phrasing in the consolidated advice note, page 1, section 1.5:

> 'Following recent events, the Expert Panel has significant concerns that consideration is not routinely given to Requirement B4 of Schedule 1 to the Building Regulations (on external walls resisting the spread of fire), particularly in circumstances where the guidance in Approved Document B is less specific. Requirement B4 is clear and requires that "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 location of the building." **The need to assess and manage the risk of external fire spread applies to buildings of any height**.' [MHCLG emphasis]

This created a new industry-perceived requirement that in addition to buildings over 18m, buildings under 18m should also be subject to an inspection. This resulted in a significant possibility that greater remediation works will be required, meaning that the risks that lenders and valuers faced only in high-rise residential buildings were now also relevant in sub 18m residential buildings. This created additional stagnation for those wishing to secure finance on the latter, exacerbating the anxiety among homeowners and increasing the backlog of properties to be inspected, further distressing the PII market.

Although this consolidated advice note was intended for use in England, it has also been used for advice in the rest of the UK, resulting in similar problems. The Local Government and Communities Directorate in Scotland has since drafted a **similar advice note for use in Scotland**, reflecting differences in legislation. Expected to be released in 2021, it reflects the English advice note in advising on inspecting lower rise buildings in addition to high-rise.

This meant that when valuing properties below 18m, valuers or lenders have been requesting an EWS1 form where the building has external wall cladding of unknown fire risk. Although this may be the correct procedure for buildings where the cladding is combustible, there have also been many instances where the EWS1 form has been requested by the lender or the valuer for low rise residential buildings with non-combustible cladding, or where the building would be deemed of a low or negligible fire risk. Ultimately this action has meant that many low-rise properties have also been entered into the EWS1 process.

In November 2020, the **Supplementary note to building safety advice for building owners** was added to the CAN by MHCLG, to provide further interpretation of points in the CAN. This short supplementary note has been published to address these concerns in low rise properties, as it states that the CAN 'should not be considered as a guide for valuation or insurance purposes'. It reiterates that ACM (or other metal composite material cladding) with an unmodified PE core is a risk on residential buildings of any height and should be removed. It goes on to recommend that owners should consider the risk of external fire spread of their building's cladding and the need for remediation if the building height is more than 18m, or if there is a risk posed by the building occupancy. However, paragraph 8.3 on page 3 of the note states the need for cladding remediation should be considered if the building (bold added for emphasis):

> 'Does not have – or have provision for – adequate risk mitigation and **has been assessed by a suitably competent person** as presenting an unacceptable risk to the life safety of residents, people in the proximity of the building, and firefighters, **regardless of the height of the building**'.

In effect, this paragraph advises that buildings of any height may still require an inspection of the cladding by an expert to deem if the cladding system should be removed. Although this supplementary note states that the CAN should not be considered as a guide for valuation, it makes no change to the text of the CAN in page 1, section 5 (above) and the potential risk to building value in buildings of all height, via the potential of cladding replacement, remains.

RICS has therefore decided to publish V*aluation of properties in multi-storey, multi-occupancy residential buildings with cladding*, RICS guidance note, for valuers with criteria outlining when an EWS1 form should be called for.

3 Cladding systems

3.1 General

Over the years, manufacturing techniques and construction materials have evolved so that they are in larger varieties, more economical to produce, lighter and easier to use in construction. The façade in turn has also changed, so that in recent years it has developed into the modern curtain wall.

Curtain walls are typically manufactured from aluminium, glass and other robust materials, giving it longevity and some resistance against fire, since most materials used in their manufacture are non-combustible.

In recent years, and in pursuit of quicker installation times, economy and simplicity, rainscreen systems have become the cladding of choice predominantly because of the vast range of materials, colours and variety available in the marketplace. These cladding systems permit older properties such as the Grenfell Tower to be refurbished very easily and at relatively low cost, resulting in a fresh and modern appearance with improved insulation behind. Newer constructions also benefit from rainscreen cladding in the same way.

However, the design, materials and construction techniques associated with rainscreen cladding can expose this system to various fire related issues and shortcomings if not specified or installed correctly. The materials used in rainscreen systems contain greater proportions of organic components, which can contribute to increased fire loads.

3.2 Identification of cladding

The type of external wall cladding system can often (but not always) be identified initially by a visual, non-intrusive inspection in combination with a review of as-built drawings and other relevant documentation, which may be found in the building's O&M manuals if these are available.

Different cladding materials can often be identified during the visual inspection, as suggested below:

- Feeling and tapping cladding material can be a useful way to identify lookalike materials such as brick-effect render, EWIS, textured GRP panels or fibre cement panels with a wood finish.
- The edges of the panels indicate whether it is a solid or a composite material. The colour of the core visible along the edge may sometimes indicate the physical and performance characteristics of the panel too.
- The size and thickness of panels can also be an indicator. Large but thin ceramic or stone cladding panels are usually lighter composites as opposed to solid panels.
- Inspect the cladding and identify any gaps or penetrations that may allow for an examination of the internal parts of a cladding system.
- Exposed insulated cores of composite panels or edge details may indicate combustible materials.
- Some materials have only been available in the last decade or two, such as ACM with flammable (PE) cores and metal insulated panels with mineral wool cores.

- Brick slips are not always easy to tell apart from solid brickwork. Brick bonds and window details can help. Stack brick bonds (brick laid with vertical joints aligned) are sometimes a marker of brick slips. However, it should be noted that reinforced, solid brickwork can be designed with stack joints. Likewise, the absence of metal lintels or slim reveals at windows and doors are also indicative of brick slips systems.

It should be appreciated that visual inspections and assessments of as-built information have limitations and an intrusive inspection is likely to be the only way to fully identify the cladding system and essential fire safety components.

3.3 Fire-stops/cavity barriers/cavity closers

Fire control measures are critical in facades, and it is equally important that the differences between the products are properly understood. This section highlights the significance of these key components since they can affect the fire risk to the occupants and potentially the value of the property.

The materials used in these control measures, together with good installation and workmanship techniques, cannot be overstressed.

3.3.1 Fire-stops

Fire-stops should not be confused with cavity barriers. Fire-stops are fitted between the backing wall and any fire-separating element (floor slabs or partitions) to maintain the continuity of fire resistance between these elements (e.g., 60 min, 90 min or 120 min). Fire resistance of fire stops must be equal to or exceed that of the elements they separate.

Fire-stops are typically made of non-combustible high-density stone wool (Class A1) and are normally covered with a foil or white ablative coating (see Figures 1 and 2)

Fire-stops are available in varying levels of fire resistance and must be tested to both EN 1366-4 and EN 1364-4 and classified to EN 13501. Fire stops are available for voids between 20mm to 250mm wide and in thicknesses to suit the specified fire resistance.

Fire stops should be installed in accordance with the manufacturers tested details, which may require compression and/or mechanical fixing.

The performance of fire-stops must match or exceed the performance of the bounding structures. For the fire-stop to perform its function, it must be fixed in accordance with the manufacturer's instructions based on their product testing to the bounding structure so that it is capable of providing adequate support to the fire-stop for the required period of fire resistance.

Any deviation from the above will likely compromise the performance of the fire-stop.

Figure 1: Typical horizontal fire-stopping with ablative coating

Figure 2: Typical horizontal fire-stops with smoke foil

3.3.2 Cavity barriers

Cavity barriers are fitted in the cavities between backing walls and the external cladding. A 30-minute cavity barrier should be fitted around window and door openings, around service penetrations, and at the top and bottom of cavities, as well as at interfaces with compartment floors and walls, and at junctions with roof cavities. Note that a cavity barrier should interrupt insulation rather than be fixed to or abut the face of insulation.

Cavity barriers are typically made of mineral wool or plastic-sleeved mineral wool fitted under compression and/or mechanically secured (see Figures 3 to 5). If fitted correctly, there should be no gaps at junctions between cavity barriers. In certain situations, ADB permits these to be formed of steel plates (at least 0.5mm thick), timber (at least 38 mm thick) or non-combustible boards. Steel or timber products of the appropriate thickness may meet the requirement for cavity barriers.

Figure 3: Typical vertical fire-stop with smoke foil

Figure 4: Typical horizontal open state cavity barriers with intumescent strip

Figure 5: Typical installation of vertical cavity barrier (work in progress)

For ventilated cavities, open-state cavity barriers with an intumescent strip must be installed horizontally to allow for air flow within the cavity. When exposed to heat, the intumescent strip will expand and close the gap between the back of the cladding and the fire barrier. The gap size is important as each type of open-state cavity barrier will have a maximum gap dimension.

It is recommended that any deviations from the prescriptive recommendations regarding the installation of cavity barriers are assessed by a chartered building surveyor or chartered engineer registered by the IFE. This further assessment should establish life safety risks, taking into consideration the characteristics and fire performance of the cladding material and backing walls, as well as other physical fire safety measures such as fire doors, smoke control systems and others. The assessment may include acceptable measures and minor remedial works.

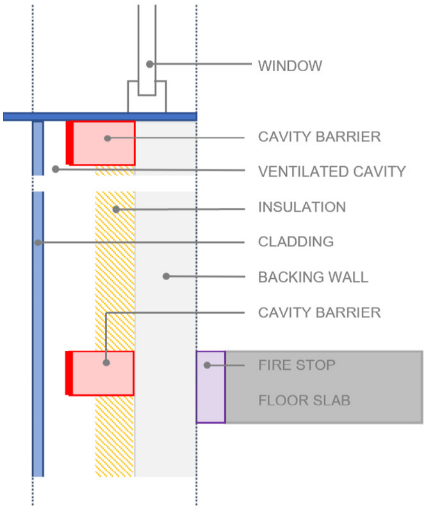
3.3.3 Cavity closers

It is important to note that cavity closers are different to cavity barriers. Cavity closers are typically specified to control watertightness, dampness, heat loss and condensation within the cavity of masonry walls and may or may not provide protection against fire spread.

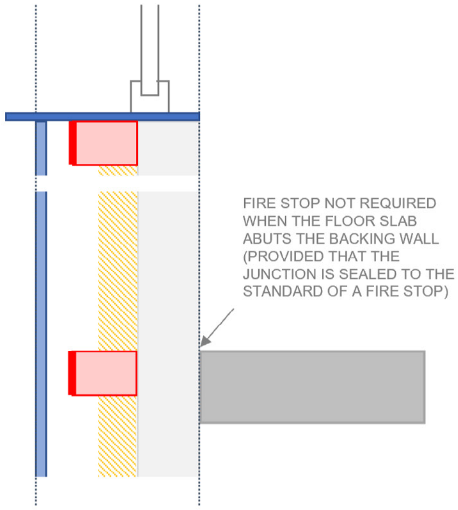
Typical, cavity closers are made of combustible PVC extrusions where the core is filled with rigid insulation (see Figure 6).

Figure 6: Typical vertical cavity closer (uPVC extrusion with rigid insulation)

See figure 7 for representative arrangements for horizontal fire stops and cavity barriers for typical façade configurations. Similar arrangements are to be followed for the installation of vertical fire stopping and cavity barriers.



EXTERNAL CLADDING (CASE 1)



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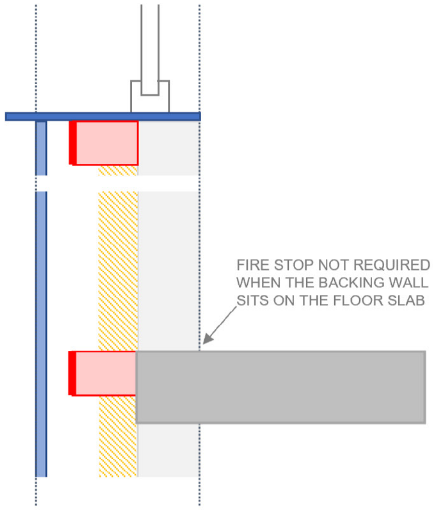

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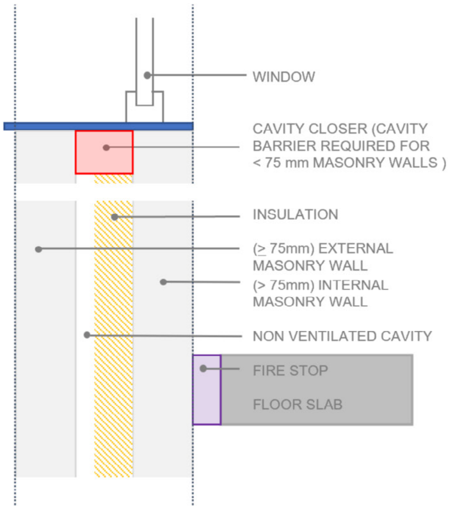

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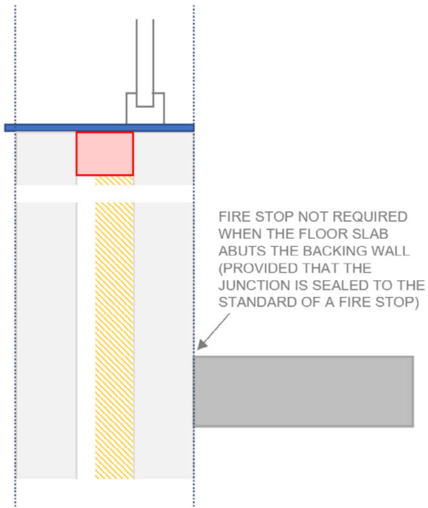

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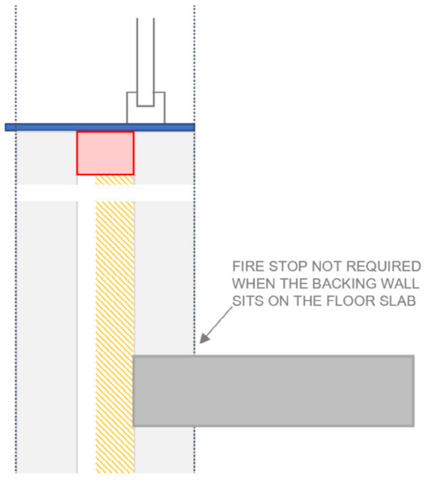

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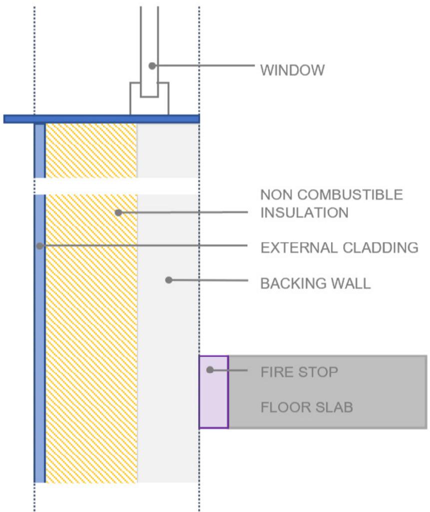

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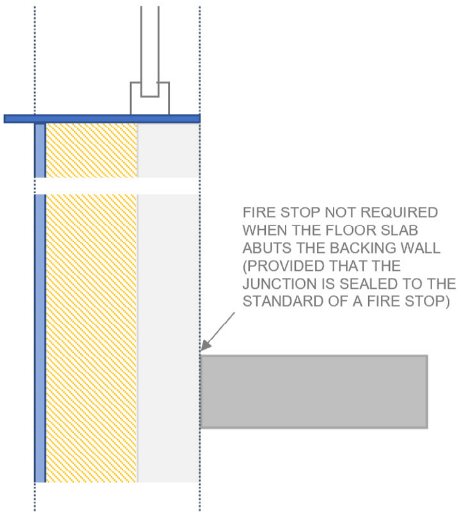

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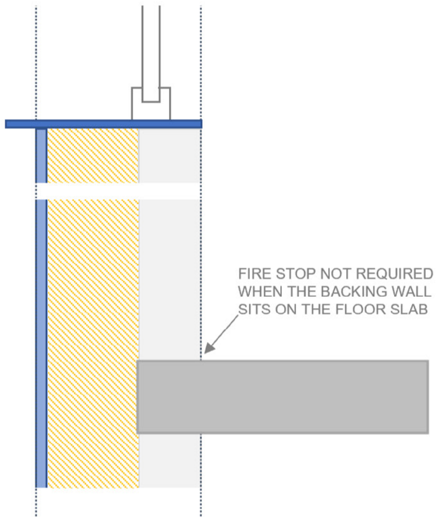

EXTERNAL CLADDING (CASE 3)

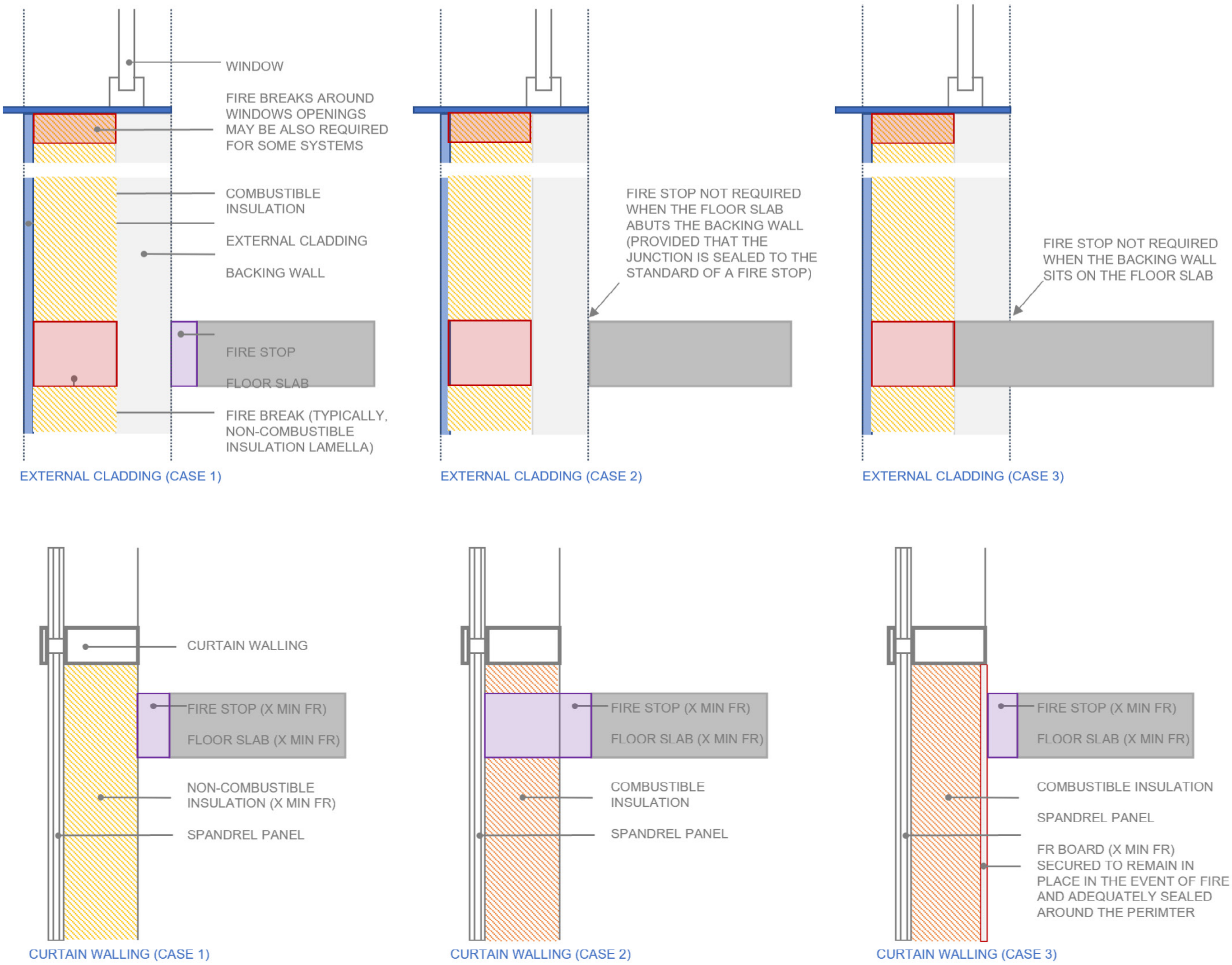

Figure 7: Examples of installation of horizontal fire stopping and cavity barriers

4 Types of external wall systems

4.1 General

An exterior wall typically forms part of a building envelope, separating the accommodation inside from the outside. Its functions include control of the environment, fire control, security, privacy, and aesthetics.

It may include openings that allow access and ventilation, together with glazing to allow light in and views out. In loadbearing construction the exterior wall may also provide support to structural and wind loads of the roof and floor construction and convey them to the foundations.

In a framed structure, the external walls may be non-loadbearing and are therefore relieved of any upper floor and roof loadings. However, they are normally self-supporting and are designed to resist wind loads, prevent the spread of fire (in accordance with BS8414 tests) and accommodate thermal movements.

4.2 Curtain wall

A curtain wall system is an outer covering of a building in which the outer walls are non-structural, provided only for protection from the weather and keep the occupants inside in a comfortable and safe environment. The wall is designed to resist lateral wind loads through connections to the main building structure at floors or columns of the building.

Fire stops must be provided between the curtain walling spandrel panels and each compartmented wall and floor at slab level to prevent the spread of fire (see Figures 8 and 9).

Figure 8: Typical installation of curtain walling and fire stopping

Figure 9: Typical fire-stop behind spandrel panel

4.3 Rainscreen cladding

In rainscreen construction, decorative cladding material is applied over old or new walls to provide a lightweight skin to improve the aesthetics of buildings, and provide thermal insulation behind the cladding, and weather resistance. Depending on the design and construction, a ventilated cavity is formed between the cladding and the backing insulation/wall, which facilitates rainwater drainage.

This cavity can create a 'chimney effect' where fire and smoke can travel unimpeded within the zone, but it can be controlled with installation of cavity barriers and fire stops. The cavity in rainscreen cladding is a weakness in the system (and therefore proper design, installation and workmanship are essential in these systems) as opposed to standard aluminium framed curtain walls.

Rainscreen systems are available in many different forms and some are discussed below.

4.3.1 Ventilated rainscreen cladding

Ventilated rainscreen cladding systems are a form of multi-layered façade construction. These popular cladding systems, are significantly different to curtain walls, comprise open jointed decorative rainscreen panels, typically fixed to a lightweight support structure comprising timber sections or aluminium extrusions secured back to an airtight backing wall. The rainscreen panels can be made of a wide variety of materials, such as metal panels (including aluminium, zinc and copper), HPL, terracotta and stone for example. Insulation boards and breather membranes are typically installed in the ventilated cavity formed between the rainscreen panels and the backing wall.

The backing wall is normally installed as a storey height infill panel, typically between floor slabs. Such panels can be assembled on site or prefabricated in factory conditions. Backing walls can also be installed as a continuous walling solution fitted in front of the floor slabs. They can also be an insulated metal sandwich panel.

Horizontal and vertical cavity barriers between the external cladding and the backing wall must be installed within the cavity. Fire stops may be also be fitted between the backing wall and the floor slabs for continuous walling solutions, depending on how the backing wall has been installed (see Figures 10 and 11).

Figure 10: Typical build-up of terracotta rainscreen cladding (note missing cavity barriers around window openings)

Figure 11: Typical installation of horizontal and vertical cavity barriers behind rainscreen cladding

The construction of non-ventilated rainscreen systems is similar to that of the ventilated rainscreen cladding, except that the joints between external cladding materials are closed and the cavity within it restricts air flow significantly.

Non-ventilated cavities may pose a lower risk in terms of fire spread compared to ventilated cavities. Nonetheless, cavity barriers and fire stops must also be provided as for ventilated rainscreen cladding.

These systems are characteristic of traditional hand-fixed natural stone cladding and facing brickwork, including cassette system cladding and brick slips (not to be mistaken with masonry cavity walls).

4.4 External wall insulated systems (EWIS)

4.4.1 Insulated render systems

Insulated renders comprise an external layer of cement or acrylic render applied onto a substrate, which would typically be EPS, mineral wool, phenolic insulation boards or blockwork (see Figure 12). The insulation boards are generally fixed to the backing wall with no cavity between components, but in some cases they may be fitted to a sub-structure, creating a cavity that must be addressed.

Figure 12: Typical render system with EPS insulation and cementitious backing board

However, render systems installed in buildings may include a drained cavity behind the insulation. There are often drained cavities between the insulation and sheathing board, requiring intumescent strips to prevent fire spread.

The overall fire performance of the insulated render systems should be assessed based on the combustibility of the render, insulation materials and the presence or otherwise of a drained cavity and any manufacturer's test information.

EWIS must also incorporate fire cavity barriers, fire stops, or both, depending on the specific build-up of the manufacturers details appropriate to the specific building height.

4.4.2 Insulated cladding panels

Commonly known as 'insulated sandwich panels' or 'insulated composite panels', insulated cladding panels are manufactured with a relatively thick insulation core (for structural integrity), with thin metal or other sheets bonded to each side of the core (see Figures 13 and 14).

Figure 13: Typical metal insulated panels with mineral wool core

Figure 14: Typical metal insulated panels with PIR/PUR core

Structural Insulated Panel Systems (SIPS) use two external sheets with an insulated core, and can be used to support external cladding.

The insulation core can consist of non-combustible mineral wool or combustible insulation materials such as PIR or PUR. In some premium products, the panel includes a peripheral, lightweight interlocking frame to encapsulate the core and assist with connecting to adjacent panels. A wide range of facing materials are available on the market, including aluminium, steel, zinc, plastisol, GRP and may include plain or ribbed with plastisol finishes.

The assessment of the insulation core in cladding panels should be based on the fire performance of the complete panel, including the core material and facing sheets. Fire stops must be installed in gaps between compartmented floor slabs and partitions and joints in cladding panels should be sealed.

4.5 Cladding materials

Various materials are available to clad modern facades. Of these, ACM with PE core and certain HPL products are of the highest risk in terms of fire performance, mainly because of the organic content of the products.

4.5.1 ACM Panels

ACM cladding consist of two skins of aluminium bonded to either side of a lightweight core of materials such as polyethylene (PE), profiled metal honeycomb ,or a mineral core. It was a popular product because of its flatness, variety of surface finishes and colours, light weight and formability, but since Grenfell, its popularity has waned.

This is because, during a fire, the panels with a PE core can delaminate, causing the flammable core material to ignite, which in turn will flame uncontrollably.

To identify whether a panel is ACM or a solid metal sheet, inspect a cut edge where the lamination will be visible. If a cut edge is not visible, a hole will need to be cut in a panel. See Figures 15 and 16 for examples of ACM cladding.

Figure 15: Typical ACM cladding

Figure 16: Close-up showing ACM core (seen at joint panel)

By its nature, solid materials are typically more robust and heavier than composite products and the edges are homogenous, without a core, laminations or composed of a mix of materials.

ACM panels are sometimes combined with solid aluminium panels within a façade. It would therefore be necessary to check the panel type in more than one location.

4.5.2 HPL Panels

High Pressure Laminate (HPL) panels are a form of cladding typically manufactured by layering multiple sheets of kraft paper or wood fibre bonded with a resin under heat and high pressure. They are available in a wide range of colours, finishes and several thicknesses to suit the structural requirements (aee Figures 17 and 18).

Figure 17: Housing block with HPL cladding

Figure 18: Close-up view of HPL cladding panel

HPL can have a plain or textured finish or a timber effect finish (see Figure 19) where a resin-saturated decorative paper is bonded directly to a plain HPL substrate panel, then topped with a clear protective sheet.

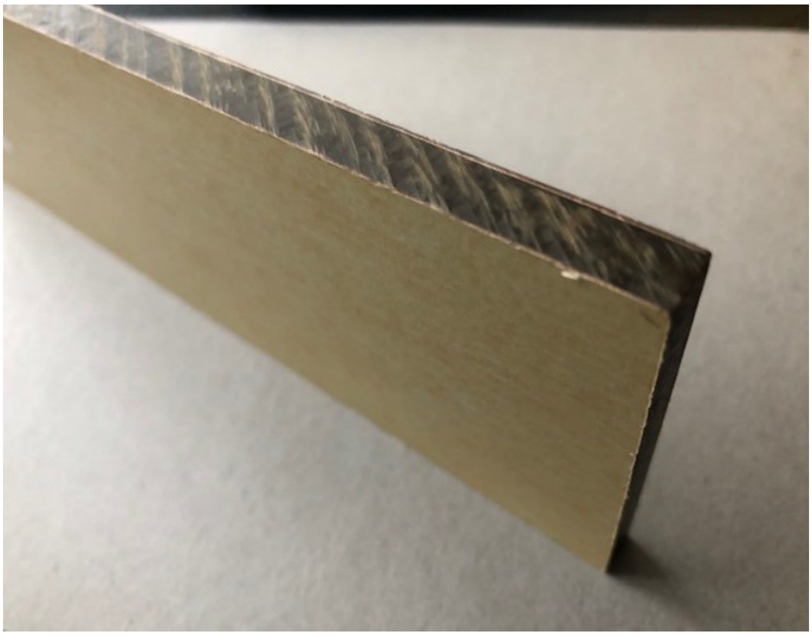

Figure 19: Edge of 8mm thick HPL cladding panel

Essentially, HPL panels are composed of significant amounts of organic material and resin, which makes it a risk in terms of fire.

Panels that incorporate fire retardant chemicals are sometimes referred to as ‘FR grade’ and these will typically achieve Class B-s1, d0. Panels manufactured without fire retardant chemicals are typically Class C or D, depending on the thickness of the panel. The term ‘FR’ should not be taken as fire resistant.

Cut edges are normally sealed in the factory but if cut on site and left untreated, the core will delaminate.

4.6 Brick slip systems

Brick slips are used as external EWS cladding systems, rainscreen cladding and non-insulated constructions. The brick slips are mechanically fixed to special carrier steel rails or boards, bonded to mineral wool or other backing materials (see Figures 20 and 21).

Figure 20: Close-up view of brick slip system

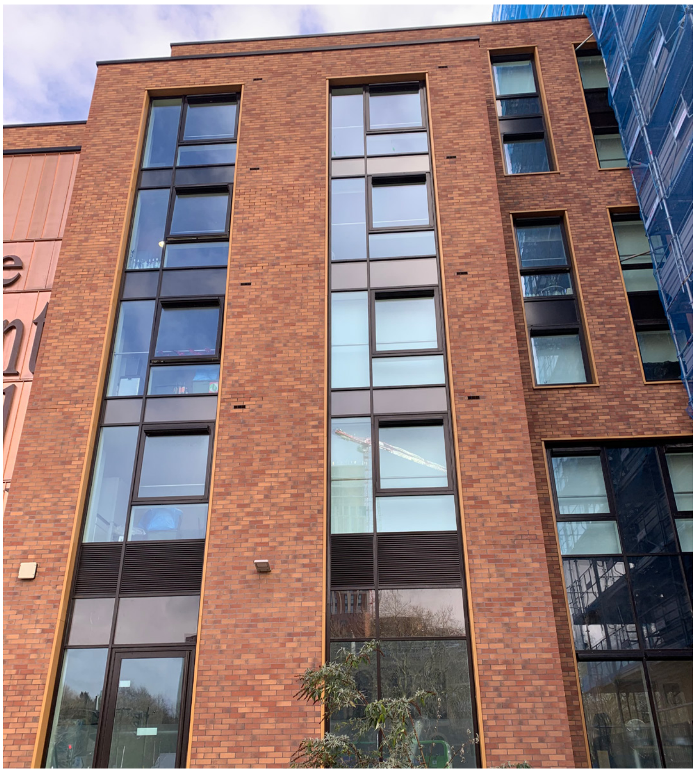

Figure 21: Brick slip façade

The fire performance of brick slip systems varies depending on the characteristics of the bricks slips or 'tiles', mounting materials and fixing methods, as well as the fire performance of the backing wall or substructure.

Fire cavity barriers and fire-stops must be installed as specified for rainscreen and EWIS systems as required. If a wall build-up has been justified by a BS 8414 test, the cavity barrier requirements should be based on the wall build-up that was tested, which would override any other guidance in relation to cavity barriers.

4.7 Masonry cavity walls

Masonry cavity walls are formed by inner and outer leaves of brickwork, blockwork, concrete or stonework connected by ties and separated by an insulated or non-insulated cavity.

Limitations regarding the combustibility of insulation materials do not apply for cavities formed behind a masonry wall with a brickwork or blockwork inner and outer leaves that are at least 75 mm thick. Combustibility is restricted for 'relevant buildings' in accordance with Building Regulation 7(2) (ban on combustible materials) and if over 18m. The same exceptions do not apply to brick cladding systems where other materials are used to construct the internal leaf, irrespective of whether such materials are combustible or not.

Similarly, provisions for cavity barriers along compartmented walls and floors do not apply for cavities formed between masonry walls and blockwork at least 75mm thick. However, cavity closers are required around window openings and at the top of the wall unless the cavity is totally filled with insulation.

4.8 Built-up metal systems

Built-up metal systems consist of liner metal sheets or liner trays filled with insulation. The liner trays or inner liner sheets are in turn fixed back to the structure. All the different components of a built-up metal system are installed and assembled on site. These systems are therefore not to be mistaken for insulated composite panels, which are factory-made products.

Built-up metal systems are commonly found in residential properties as standing seam systems, a variant of built-up metal systems featuring raised seams and a broad, flat area between them. However, it should be noted that some standing seam systems are built in a traditional way comprising a timber substructure and lining.

Provisions for fire compartmentation must comply with the requirements indicated above for other façade typologies. Fire stops must be installed along any gaps between the metal system and compartmented floor slabs and walls. Systems comprising a cavity must be protected against fire spread with cavity barriers.

4.9 Precast concrete panels

Also known as 'architectural wall panels', precast concrete panels are large façade modules manufactured off-site. The panels typically span one storey and are secured back to the structural frame of the building (see Figure 22). They can also be designed to be load-bearing or self-supporting.

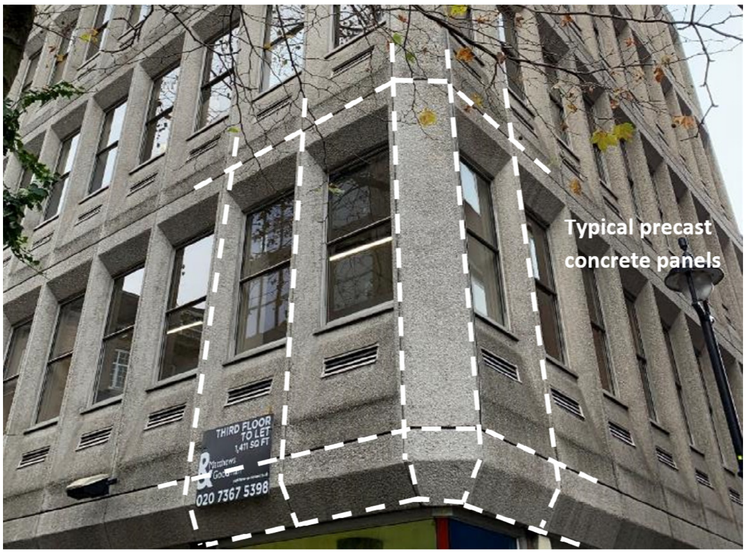

Figure 22: Façade comprising precast concrete panels

Insulated precast panels incorporate an internal insulation later between the two concrete leaves.

This type of cladding can be designed with a wide range of textures and can also incorporate brick and stone facing materials. Panels can be of concrete or reconstituted stone.

Fire stops or cavity barriers are typically not required for these façade types. Nonetheless, self-supporting panels may require fire stops fitted between the inner leaf and compartmented walls or floor slabs.

4.10 Balconies and attachments

This category includes high risk materials such as timber, synthetic textiles, combustible composites and binding agents in adhesives.

Timber decking and balustrades to balconies have been linked to the spread of fires and their presence should be included in the overall building fire risk assessment. Timber decking, balustrades and brise soleil are required to conform to the Building Regulations and their presence should be noted (see Figure 23). In overall terms, remediation is usually simple and the cost is relatively small.

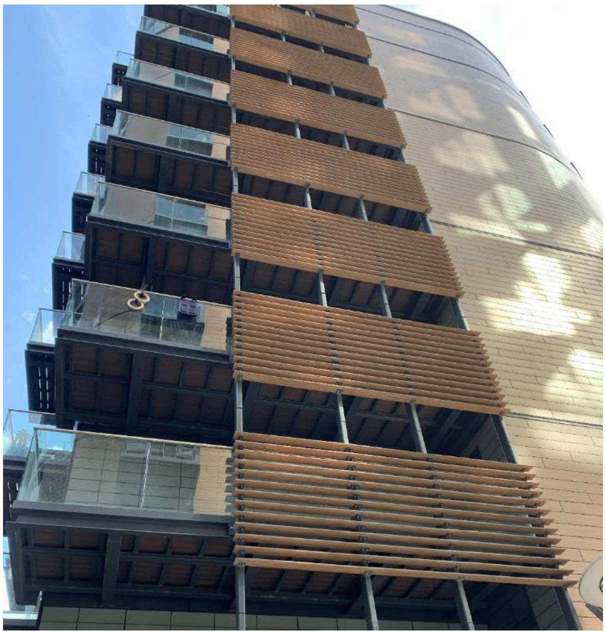

Figure 23: Balconies with timber decking and timber brise soleil

Refer to BS8579 Section 12 for more information on fire performance and the many different types of balconies and terraces.

Special attention should be paid to materials that may not appear combustible but are flammable, for example some brick slips systems and the adhesives used to bond them to the substrate.

Special consideration should be given to the following:

- **Balconies:** These may include combustible timber decking, balustrades or timber by-products formed with flammable resin and subsequently overpainted with oil based paints.
- **Canopies:** Canopies can be constructed from various materials including aluminium sandwich panels, PTFE, PVC and timber. Glass is a common material.
- **Brise soleil:** These shading devices are typically of opaque materials such as timber, HPL, aluminium and other materials.
- **Shutters:** Mainly in timber or aluminium in the UK for security, decorative effect and protection from the weather.

- **Other decorative features:** Decorative timber and rainscreen cladding used increasingly for architectural effect.

Toughened and laminated glass is often used in balcony construction. Laminated glass is currently considered to be the best option and good practice in term of glass safety for occupants and people standing below in the event of a breakage. However, it incorporates a combustible polyvinyl butyral (PVB) interlayer. This is seen as a low risk product and is currently being researched by various parties. This guidance note will be updated as more information becomes available.

4.11 Renders

Renders are decorative finishes to a building for weatherproofing it and to improve its aesthetics. Traditionally these were of cement or other cementitious products, but synthetic materials have also entered the marketplace, each with a greater fire risk due to its organic properties.

Some of these renders are listed below:

- **Cement render:** Cement renders are some of the most durable types of renders available and are inherently a safe material.
- **Lime render:** Sometimes referred to as a traditional 'natural hydraulic lime render (NHL)'. This material has been utilised on all types of buildings for many years and is safe once applied and cured.
- **Acrylic render:** Acrylic render is typically a thin, synthetic finish applied to a substrate, which may include blockwork, concrete or brick. It can also be applied to insulation such as mineral wool and expanded polystyrene. When applied to expanded polystyrene, the system is considered to be a high fire risk.
- **Polymer render:** Polymer render is a cement based decorative finish with specially selected polymers added to the mix allowing them to be used on a number of different substrates. This is generally considered to be a low fire risk.
- **Monocouche render:** This render is a type of self-coloured decorative finish applied to the outside of buildings to provide both decoration and weather protection in a single layer. They do not usually contribute to the fire load.
- **Insulated render:** These are relatively thin cement or synthetic renders applied onto an insulated substrate of mineral wool or polystyrene. The fire risk depends on the type of render and substrate, with polystyrene being high risk. Brick effect render (BER) comprises usually two layers of render, which imitate a brick effect over the insulated substrate.

Appendix A: Risk status table for different materials

Table 1 outlines the typical risk status for different materials usually found in standard cladding systems for high rise (above 18 metres) residential properties only. The ratings are provided for guidance only. These materials may have differing risk status in other types of buildings such as industrial, etc. Specific cladding systems containing combustible materials can pass the requirements of BR135 when tested to BS8414.

	High-level risk	Medium-level risk	Low-level risk
Cladding panels	Non-FR ACM PE cored Non-FR HPL panels Natural wood cladding Laminated wood panels in CLT GRP panels PVC cladding boards	FR HPL FR ACM Honeycomb bonded panels Brick slips (see below) Basalt panels (Rockwool*) Composite stone panels Acrylic polymer (corian*) Glass composite Glass-fibre reinforced polymer composite panels (Steni*) Brick slips (see below)	Metal panels Terracotte tiles Natural stone panels Reconstituted stone panels GRC panels Fibre cement cladding Precast brick panels Precsat concrete panels
Brick slips	GRP backed system Insulated brick slip system	Cement particle board board system Magnesium oxide panel backed system	Steel backing (Corium*)
Render systems	Render on EPS insulation render on phenolic insulation		Render on mineral wool
Insulated panels	GRP panels with non-mineral wool insulation core Metal insulated panels with EPS/XOS insulation core	Metal insulated panels with hybrid closed-cell insulation core (QuadCore™ by Kingspan*) Metal insulated panels with PIR insulation core Metal insulated panels with PUR insulation core Metal insulated panels with PF insulation core	Metal insulated panels with mineral wool insulation core
Insulation materials	PIR insulation boards PUR insulation boards XPS insulation boards PF boards		Stone wool insulation Glass wool insulation
Backing wall	Timber frame Timber sheathing boards Insulated Concrete Form (ICF)	SIPs panels Composite metal panels	Concrete Blockwork Brickwork Non-insulated SFS with cement particle sheathing boards SFS with cement particle sheathing boards and mineral wool

Risk levels are as follows:

- **High-level risk:** materials are typically rated as Euroclass B or lower.
- **Medium-level risk:** material are typically rated Euroclass B. However, some material within the specified range of products can achieve Euroclass A.
- **Low-level risk:** materials are typically rated as Euroclass A1 or A2.

Table 1: Typical risk status for different materials

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