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Booth Muirie has gained national recognition for the provision of a comprehensive range of specialist architectural cladding services, including design, manufacturing and distribution.

Cost effective, time sensitive solutions can be identified, without compromising service quality, through the combined knowledge and expertise within the company.

Creating innovative architectural solutions for over 40 years

With a strong awareness of market demands and a progressive, forward thinking approach to ever-evolving design trends, Booth Muirie has positioned itself as a highly respected specialist company within the construction industry.

Booth Muirie uses a range of metal composite materials (MCM), predominantly aluminium composite materials (ACM), to manufacture rainscreen cladding systems. MCMs consist of two thin skins of aluminium or other metals such as copper, zinc and stainless steel, continuously bonded under tension to either side of a thermoplastic or mineral core.

Booth Muirie rainscreen constructions are referred to as BML Systems, with the different constructions recognised by a standard prefix of BML (Booth Muirie LINEAR), followed by a specific reference, which identifies the system construction, such as BML200.
Rainscreen is a cladding applied either during primary construction or as an over-cladding to an existing structure. Rainscreen cladding consists of an outer weather-resistant decorative skin fixed to an underlying structure by means of a supporting grid, which maintains a ventilated and drained cavity between the façade and the structure.

Rainscreen façades are not normally sealed and a ventilation cavity of at least 25mm is allowed immediately behind the cladding panel. Insulation can be positioned within the cavity whilst openings at the top and bottom of clad areas allow for evaporation of moisture vapour and ventilation/drainage.

A ventilated rainscreen incorporating insulation will allow the building fabric to breathe without the risk of interstitial condensation or structural decay. External wall insulation used in this way is superior in performance as it eliminates the condensation risks associated with internal or cavity wall insulation. This is particularly important for refurbishment schemes. In new construction the use of back ventilated rainscreen cladding provides the designer with the opportunity to use economical single skin load bearing block work for infill walls.

The need for complicated damp proof membrane detailing is eliminated and there will be less risk of cold bridging. The air gap provides ventilation and depending on the design of the rainscreen, in conjunction with ventilated panel joints, it may also assist in providing pressure equalisation across the outer skin.
Fully pressurised and compartmentalised (zoned) systems control airflow locally and are usually used on high performance, multi-storey developments. Where lower performance is required, for example in low rise structures, then a similar cassette panel system, although not fully pressure equalised, performs well.

The pressure equalisation concept is realised when outside air pressure is transferred to an air space behind the exterior cladding. The air gap compartments must be small enough, the air barrier system must be airtight enough and the area of the venting through the rainscreen must be large enough to allow sufficient air to move in and out of the compartments under the applied air pressure. The strategy relies on the control of airflow within and through the wall assembly.

In theory, pressure equalisation means a zero air pressure differential at all times across the rainscreen, resulting in a complete elimination of the driving force for pressure-induced water penetration.
The design and manufacture of engineered rainscreen façades, featuring ACM or MCM, is at the heart of what Booth Muirie does. The company has built a reputation for providing rainscreen cladding solutions for a comprehensive range of projects and has an exceptional architectural portfolio. This is due, in no small part, to the design capabilities of the business.

The Design Team uses modern computer aided design (CAD) software to help deliver creative architectural solutions. Technically innovative cladding systems are delivered through the interpretation of architectural drawings and the creation of in-house details. This design ability perfectly complements Booth Muirie’s capabilities as a leading fabricator, by ensuring pragmatic solutions are developed, which can be efficiently manufactured.

Design team

A Project Designer is appointed to work closely with customers to ensure effective communication and project management. The team of designers employed by Booth Muirie has worked on a comprehensive range of architectural projects, offering customers a variety of drawing services and full compatibility through the use of the latest CAD software.

The standard Booth Muirie products cover many requirements but there may be a need to provide bespoke details or features. Booth Muirie takes pride in the ability to offer flexibility in design and manufacture, working in-house or in partnership with specialist consultants to achieve a solution that best fits the design aspirations.

Technical support

Full technical support is available on all aspects of service and products. Materials are fully compliant and tested to the relevant industry standards, whilst manufacturing processes are certified ISO 9001.

Facade panels

Bespoke façade panels, using established installation systems, can be supplied in a wide range of MCMs, particularly ACM, which opens up a host of possibilities in terms of colour and finish. Panels can be supplied in different shapes and sizes to suit almost any façade design; from the simplest linear form to the most avant-garde design.

As well as rainscreen panels Booth Muirie can produce spandrel panels that can be tailored to the colour scheme of the building, creating a match or contrast with the glazed area and offering the opportunity to enhance the visual impact of the curtain wall or glazing.

Feature detailing

Combined with façade panels, feature details offer a solution to complete all roof and wall interfaces. These can include bullnoses, transitions and corners, highly flexible flashings, interior walls and ceilings, column casings and soffit panels. Window, door and curtain wall interfaces are also available.

Booth Muirie systems can help achieve grand designs or add that special finishing touch. The accuracy of the CAD modelling team ensures that every panel fits as intended. For details of the manufacturing constraints relating to any particular material please contact the office.
Booth Muirie has been manufacturing rainscreen systems in the UK and Ireland since 1978. Using original concepts, the company has evolved and innovated to become a key presence in the technically challenging rainscreen cladding market. Since becoming a Euroclad company, Booth Muirie has continued to grow, through a commitment to technical excellence and robust supply.

Concept to reality

It all begins with the Booth Muirie technical team. Years of system and detailing expertise means that design expectations can be defined and achieved, whilst ensuring Building Regulation compliance. Optimum manufacturing and installation options are advised to achieve the fastest, most cost-effective solutions.

Once a Bulk Order is placed the production process commences. Material is allocated from stock or ordered to specification, whilst system drawings are created by the Technical Drawings team. Following contractual sign off, delivery dates are agreed.

Bespoke software

The next stage of the process is an advanced software solution that has been exclusively designed and developed for Booth Muirie. Through the integration of existing and bespoke software, drawing files link with the panel production details, which are then imported into the production machinery. This advanced process optimises sheet utilisation and minimises machine time, keeping material and processing costs to a minimum by reducing waste and improving efficiency.
The software also creates works orders and allows a view of where each panel for each job is within a production run. Each panel has a unique identification number that is used throughout the production and delivery process and is shown on the panel as a QR code. The QR code is a clever bar code solution that is easily read by a range of devices including iPads and smartphones. As well as containing the panel ID number the QR code can also be created with useful data for site operatives.

Once material is allocated to the works order and scheduled, files are downloaded to the router and production can begin.

**Material routing**

Cutting, drilling and routing ACM is performed by large, flat-bed, multi-tool machines, that are operated and monitored by experienced staff as they follow a pre-programmed set of actions, based on the previous stages of the process.

The routing of ACM means that sheet and panel sizes can be processed in lengths of more than seven metres, with the 'v’ groove routed into the panel providing an easily folded edge. This avoids any requirement for machine folding and any associated process restrictions. As such, the panels are finished by hand, after being uniquely labelled and then scanned.

**Assembly**

Panels are scanned into the assembly process and finished by hand using the most suitable methods for the kind of panel being assembled.

Once complete, panels are stored in a dedicated area ready for packaging, away from the hustle and bustle of production and assembly.

**Packing and loading**

Panels are packaged on pallets, with each pallet also featuring a unique QR Code that can be traced to the relevant works order. Operators scan the panels while packing them, which shows the progress of the work order and highlights any items left to pack, as well as their current position in the production process. When a pallet of panels is completed, specific paperwork and labels are automatically created and the loaded pallet is made available for delivery.

The QR code sticker is removed from the pallets as they are loaded onto the delivery vehicle and placed onto the loading document. They are then scanned to record the movement of the pallet from packing to delivery. This also prompts the creation of delivery notes and provides information to SAGE invoicing systems.

**Traceability**

The pallet QR code can be scanned by any mobile device with a QR Code Scanner App, which can record the information for easy panel tracking. This has been embraced onsite as a key benefit of Booth Muirie’s product supply, locating the correct panels infinitely faster, easier and more accurately than previously possible.

The entire process and its stages are fully audited, providing complete traceability throughout production, packing and delivery. Armed with this level of detail, processes are continually improved where appropriate and this has resulted in significant enhancements to production planning, delivery scheduling and stock control. The benefit of this to Booth Muirie customers is increased productivity, quality and reliability.
FEATURES AND APPLICATIONS

The wide range of materials and panel types available to Booth Muirie’s BML Systems allows the designer the freedom and confidence to realise inspiring building designs.

The nature of the composite materials used in BML Systems provides rigidity, flatness and colour uniformity. BML Systems can be applied to new or refurbished buildings and they can be used to great effect for a wide variety of applications; from the entire facade of monolithic high-rise buildings to feature details that are distinctive and charming.

Booth Muirie designs and manufactures a wide range of products, which offer a variety of solutions for diverse applications, including:

1. BML Systems for rainscreen cladding
2. Spandrel panels
3. Soffit panels
4. Column casings
5. Bullnoses and roof perimeter details
6. Interior partitions and ceilings.

Booth Muirie can help achieve grand designs or add that special finishing touch; providing a wide choice of products, supported by precise design, engineering and manufacturing.
SYSTEMS

Booth Muirie systems provide a wide range of choice in terms of materials, colours, finishes, panel types and panel orientations. They are also suitable for installation as part of a variety of substructures, meaning that the systems are versatile, relevant and practical for a host of design specifications.
Materials

BML Systems are available in a wide range of MCMs including zinc, copper, aluminium, stainless steel and titanium, as well as the ever-popular ACM. More information on materials, colours and finishes is contained on pages 24 to 27.

Substructures

BML Systems are suitable for use with steel, concrete, brick, block or timber substructures. The Rainspan system, supplied in partnership with Eurobond, combines the performance of a structural insulated panel with the aesthetics of Booth Muirie rainscreen construction.

Panel options

A range of panel types is available incorporating standardised systems as well as bespoke solutions. Curved and non-standard panels can be produced, offering design flexibility. Panels can be laid to suit specific design requirements, in horizontal or vertical format, as stepped panels or even as irregular diagonals.
An open joint rainscreen system with variable joint widths, which can be used for landscape panels as part of a vertical wall cladding system.

| Substructure | 1. Two layers of 2.5mm plasterboard  
| 2. Vertical studs at maximum 1m centres  
| 3. Mineral fibre insulation  
| 4. 12mm cement particle board  
| 5. Waterproof sheet  
| 6. Adjustable wall bracket |
| Rainscreen insulation | 7. Rigid board or dual-density slab (may or may not be present) |
| BML60 | 8. BML Smart Fixing System  
| 9. BML60 panel |
A hook-on, open joint rainscreen system with variable joint widths which is best suited for portrait panels as part of a vertical wall cladding system, as well as fascia applications.

Available with a hook-and-pin or a hidden plate variation of hook-on BML Smart Fixing Systems.

### Substructure
- 1. Two layers of 2.5mm plasterboard
- 2. Vertical studs at maximum 1m centres
- 3. Mineral fibre insulation
- 4. 12mm cement particle board
- 5. Waterproof sheet
- 6. Adjustable wall bracket

### Rainscreen Insulation
- 7. Rigid board or dual-density slab (may or may not be present)

### BML100
- 8. BML Smart Fixing System
- 9. BML100 panel
A mechanically-fixed, open joint rainscreen system with a standard 18mm horizontal joint width, which is suitable for landscape panels as part of a vertical wall cladding system, as well as soffit and canopy applications.

**Substructure**
1. Two layers of 2.5mm plasterboard
2. Vertical studs at maximum 1m centres
3. Mineral fibre insulation
4. 12mm cement particle board
5. Waterproof sheet
6. Adjustable wall bracket

**Rainscreen insulation**
7. Rigid board or dual-density slab (may or may not be present)

**BML120**
8. BML Smart Fixing System
9. BML120 panel
A mechanically-fixed system, with a joint width of 20mm, which is suitable for all panel formats as part of a vertical wall cladding system, as well as soffit, canopy and column casing applications.

**Substructure**
1. Two layers of 2.5mm plasterboard
2. Vertical studs at maximum 1m centres
3. Mineral fibre insulation
4. 12mm cement particle board
5. Waterproof sheet
6. Adjustable wall bracket

**Rainscreen insulation**
7. Rigid board or dual-density slab (may or may not be present)

**BML200**
8. BML Smart Fixing System
9. BML200 panel
A face fixed rainscreen system which is suitable for all panel formats as part of a vertical wall cladding system, as well as soffit and column applications.

<table>
<thead>
<tr>
<th>Substructure</th>
<th>1. Two layers of 2.5mm plasterboard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Vertical studs at maximum 1m centres</td>
</tr>
<tr>
<td></td>
<td>3. Mineral fibre insulation</td>
</tr>
<tr>
<td></td>
<td>4. 12mm cement particle board</td>
</tr>
<tr>
<td></td>
<td>5. Waterproof sheet</td>
</tr>
<tr>
<td></td>
<td>6. Adjustable wall bracket</td>
</tr>
<tr>
<td>Rainscreen insulation</td>
<td>7. Rigid board or dual-density slab (may or may not be present)</td>
</tr>
<tr>
<td>BML400</td>
<td>8. BML Smart Fixing System</td>
</tr>
<tr>
<td></td>
<td>9. BML400 panel</td>
</tr>
</tbody>
</table>
The BML NORBO interlocking cladding system is made up of extruded aluminium sections, providing a durable facade with an attractive appearance, in a choice of colours and finishes.

### Substructure
1. Two layers of 2.5mm plasterboard
2. Vertical studs at maximum 1m centres
3. Mineral fibre insulation
4. 12mm cement particle board
5. Waterproof sheet
6. Adjustable wall bracket

### Rainscreen Insulation
7. Rigid board or dual-density slab (may or may not be present)

### BML NORBO
8. BML Smart Fixing System
9. BML NORBO 220 profile
10. BML NORBO 554 profile
11. BML NORBO 605 profile
Opus is a plank cladding product that can be installed as a BML System.

**Substructure**
1. Two layers of 2.5mm plasterboard
2. Vertical studs at maximum 1m centres
3. Mineral fibre insulation
4. 12mm cement particle board
5. Waterproof sheet
6. Adjustable wall bracket

**Rainscreen insulation**
7. Rigid board or dual-density slab (may or may not be present)

**BML OPUS**
8. BML Smart Fixing System
9. BML OPUS panel

**UNDULATIONS IN PANEL**: Due to the materials and processes used to manufacture Opus panels it is normal to see variations and undulations in its surface after installation. This characteristic is inherent in Opus panels and is part of the aesthetic appeal of the product. It is not considered a fault. It should be noted that darker colours and smooth coatings are more prone to visible variations in the flatness of the pan. Horizontal orientation of panels, low incident light, along with the alignment and tolerances of the supporting structure can also contribute to making the effect more noticeable. Maximum module width 300mm.
Spandrel panels are used in place of glazing units in curtain walling systems where it is necessary to hide the edges of floor slabs, ceiling details, insulation and other building elements.

1. ACM panel
2. Aluminium tray casing
3. Insulation
4. Proprietary curtain walling section
RainSpan®

Rainscreen support panel system

RainSpan® is a stone wool core composite panel which acts as a long-spanning substrate to rainscreen support systems, providing high levels of fire protection and thermal performance. Supplied by Eurobond Laminates Ltd, one of the UK’s biggest manufacturers of non-combustible composite panels, RainSpan® can be used as a substrate for any standard or bespoke BML System.

RainSpan® is the perfect structural support for rainscreen systems, combining ease and speed of installation to create a weathertight building envelope early on in the build programme. An independent cost comparison was commissioned in 2014, carried out by Faithful & Gould, which concluded that RainSpan® combined with rainscreen systems can be constructed with cost savings of up to 40% versus traditional blockwork and jumbo metal stud back walls.

The Eurobond RainSpan® panel is tested and approved to the fire-related, insurance driven Loss Prevention Standard LPS 1208 as well as countless relevant construction standards, including structural and weather integrity performance to CWCT standards and fire resistance tests conducted in accordance with BS EN 1364 Part 1, to ensure ‘built-in passive fire protection’.

Eurobond Laminates Ltd provides environmentally friendly design solutions. The RainSpan® panel system has been independently tested for air tightness, achieving outstanding air permeability results of less than 1m³/hr/m², whilst featuring excellent thermal insulation provided by the stone wool core. This combined thermal performance helps to reduce lifetime operational costs and improve energy performance. RainSpan® is manufactured from materials with high recycled content and the panels are fully recyclable.
MATERIAL SUPPLY

The materials used by Booth Muirie are Metal Composite Materials, known as MCMs. These are comprised of two metal skins that are bonded to a central core, encompassing a range of metals, such as copper, titanium and steel. The most popular MCM used in the construction of rainscreen façades is Aluminium Composite Material (ACM).

MCM is ideal for the construction of rainscreen façades, providing the malleability that perfectly suits it to panel formation using advanced cutting and routing machines. This workable property combines with rigidity and flatness for a clean, unblemished façade surface. It also weighs much less than equivalent gauge solid material, making it easier to handle and subsequently easier to manufacture and install.

MCM offers the designer greater flexibility, features excellent flatness and rigidity, and is lightweight; providing a universally suitable material for rainscreen façade design, manufacture and installation.

Booth Muirie is an independent fabricator and can use any brand of ACM that is listed in a building’s specification. Three of the most popular ACM/MCMs are ALPOLIC®, ALUCOBOND® and larson®, which are all available from Booth Muirie. The table below provides a general reference to these three brands.

Visit the Materials section of the Booth Muirie website to access more information and to download material colour charts.

<table>
<thead>
<tr>
<th>Brand</th>
<th>ALPOLIC®</th>
<th>ALUCOBOND®</th>
<th>larson®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>Mitsubishi Plastics</td>
<td>3A Composites</td>
<td>Alucoil</td>
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<tr>
<td>Material</td>
<td>ALPOLIC®/fr ALPOLIC®/A2 ALUCOBOND® plus ALUCOBOND® A2 ALUCOBOND® larson® (FR) larson® (PE)</td>
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<tr>
<td>ACM</td>
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<td>MCM</td>
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<td>6mm ● ● ● ● ●</td>
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<td>Polyethylene ● ● ● ● ●</td>
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<td>Special finishes ● ● ● ● ● ● ●</td>
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<td>Anodised aluminium ● ● ● ● ● ● ●</td>
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<td></td>
<td>Zinc ● ● ● ● ● ● ●</td>
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<tr>
<td></td>
<td>Stainless steel ● ● ● ● ● ●</td>
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<tr>
<td></td>
<td>Titanium ● ● ● ● ● ●</td>
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</tbody>
</table>

Visit the Materials section of the Booth Muirie website to access more information and to download material colour charts.
Fire performance of ACM

The resistance to fire performance of ACM is influenced by the combined performance of the painted aluminium surface and the core material. The type of core material used and the manner in which it is fused to the aluminium skins is the primary influencer in respect to the composite material’s resistance to fire.

There are generally three types of ACM available with differing levels of resistance to fire.

These typically feature three types of core:

• Polyethylene (PE) is combustible;

• Fire Resisting (FR) contains a mixture of combustible polyethylene and minerals that limit the proliferation of flame and restrict the development of smoke;

• A2 primarily consists of minerals that limit the proliferation of flame and restrict the development of smoke.

As an independent fabricator, Booth Muirie can offer ACM with any of these three core types however not all brands of ACM are available with FR or A2 cores. For detailed information on the resistance to fire performance associated with the ACM brands commonly used by Booth Muirie visit www.boothmuirie.co.uk.
1. Solid colours

There are a wide range of standard colours available to meet design requirements. ACM is available for solid colours, which are sufficiently varied to meet the majority of colour specifications.

2. Metallic colours

Some of the most popular colours that are specified for ACM rainscreens are metallic ones. Colours such as silver metallic have been used on seminal buildings for the last decade and their popularity endures; combining stylish looks with the peace of mind of a tried-and-tested colour.

3. Special finishes

There are a number of interesting special finishes, including sparkling and prismatic colours, as well as patterned finishes with the appearance of timber, stone and metals such as weathered copper.

4. Anodised ACM

Anodised aluminium features a strong coating, which forms on the surface of aluminium as part of the anodising process. The result is an extremely hard substance. Special dyes and processes can be used to colour anodised aluminium to achieve distinctive colours, pseudo-metal finishes and other unique effects.

5. Natural metals

Natural metals are MCMs that feature genuine metals that behave in exactly the same way as standard material but with the additional benefits of a composite material. The natural metals available are:

- Copper Composite Material (CCM)
- Stainless Steel Composite Material (SCM)
- Titanium Composite Material (TCM)
- Zinc Composite Material (ZCM)
- Brass Composite Material (BCM).
1. Southern General Hospital, Glasgow.
4. WJEC.
5. Princess Hay.
5. Copper Egg.
Designing multi-layered walls that are compliant with Approved Document B2, featuring rainscreen panel systems formed from ACM.

Introduction

Rainscreen cladding systems, including those from Booth Muirie, are increasingly popular in modern construction, particularly on buildings with storey heights of 18m or more above ground level. This raises questions about building regulation compliance for fire safety.

Where buildings are less than 18m in height, there is no restriction on the use of combustible materials, meaning that any option and combination of materials is possible. If the building has a storey of 18m or more above ground level, the Building Control Alliance recommends four options for showing compliance with paragraph 12.7 of Approved Document B2. These options are outlined below.

Option 1

The first and most straightforward way to design a rainscreen system to be compliant with AD B2 is to use only non-combustible and/or limited combustibility materials for all significant elements of each and every layer of the wall.

This would therefore include: internal lining boards; insulation within the back wall (if any, except if the back wall is masonry cavity construction, which is excluded); sheathing boards; insulation within the rainscreen cavity (if present); and rainscreen panels.

This restricts the choice of materials to those listed ‘Non-Combustible or Limited Combustibility’. Limited combustibility (Euroclass A2, or better) can be defined as materials which are classified as non-combustible or fulfilling the criteria detailed in AD B2 Tables A6 and A7 respectively. If in doubt a copy of the products Declaration of Performance (DOP) should be obtained, which will clearly indicate the EN 13501-1/2 Reaction to Fire Classification. Gaskets, sealants and similar non-significant elements can be omitted from the limited combustibility definition.

Option 2

If one or more of the layers is not defined as ‘Non-Combustible or Limited Combustibility’, then a second route to compliance is possible. This second option for compliance is to follow the procedure set out in ‘BR135 Fire performance of external thermal insulation for walls of multi-storey buildings for cladding systems’ using full scale test data from BS 8414-1 or BS 8414-2. This test is expensive and a positive result cannot be guaranteed.
It is important to note that where an insulant does not fulfil ‘limited combustibility’ criteria and claims to comply with testing to BS 8414, the compliance is only relevant to the specific build-up that has been tested, using methodology described in BR135. Notable but not exclusive variances include rainscreen material type/brand, insulation thickness, multiple insulation layers and sheathing board type.

There have been positive BS 8414 tests of constructions featuring combustible elements but at the time of publish no known tests on multi-layered wall constructions featuring ACM rainscreen panels have been completed.

Option 3

Whilst not supported by AD B2, BCA Technical Guidance Note 18 does offer a third option stating: “If no actual fire test data exists for a particular system, the client may instead submit a desktop study report from a suitable independent UKAS-accredited testing body (BRE, Chiltern Fire or Warrington Fire) stating whether, in their opinion, BR135 criteria would be met with the proposed system. The report should be supported by test data which the test-house already has in its possession and so this option may not be of benefit if the products have not already been tested in multiple situations/arrangements. The report should also specifically reference the tests which they have carried out on the product.”

There are a number of projects featuring ‘FR’ (fire resistant) and A2-grade ACM rainscreen panels, in combination with various combustible insulation types, that have achieved compliance using this option. As these are project specific they cannot be used as supporting evidence for other projects or as a design guide.

Option 4

If none of the above options are suitable, the client may consider addressing this issue via a holistic fire-engineered approach, taking into account the building geometry, ignition risk, factors restricting fire spread etc. Such an approach would be expected to follow a recognised design code such as BS 7974 (Application of fire safety engineering principles to design of buildings suite of documents) and be supported with quantitative analyses where appropriate. It must be noted that this is a complex process, with eight parts to BS 7974:2001.

Conclusion

Taking into account all available information it appears that options 2, 3 and 4 illustrate that the simplest way to design a rainscreen system that is compliant with AD B2 featuring Booth Muirie’s rainscreen panels is to only incorporate non-combustible and or limited combustibility products throughout the wall construction (Option 1).

This guidance is based upon information available at the time of issue and may be subject to change. The Approved Documents should be consulted for full details in any particular case. We would recommend that this is read in conjunction with BCA Technical Guidance Note 18.
Building Regulations set the standards and guidelines for the thermal insulation required within wall constructions for both new build and refurbishment projects, with thermal insulation performance expressed as a U-value.

The required U-value will depend on the location of the project (England, Scotland, Wales) and type of building (domestic, non-domestic). The requirements for the conservation of fuel and power, which includes thermal insulation, in buildings in England are detailed in Approved Documents (AD) L1A, L1B, L2A and L2B to the Building Regulations 2013 which came into effect on 6th April 2014.

With the exception of insulated spandrel panels, BML rainscreen panels do not contribute to the thermal performance of any given wall construction.

The U-value performance is governed by the performance of the various layers associated with the structural wall and is further defined by the stud wall insulation used. The thermal performance of a through-wall construction featuring a BML rainscreen system is usually enhanced by the addition of an insulation layer that sits outside of the substructure, in a ventilated cavity behind the external panels.

Whilst this insulation is protected by the BML panels, any insulation used in this layer must be water resistant and specifically designed for use in ventilated rainscreen cavities, due to it being in the ‘wet zone’ of the through-wall construction. It is standard practice for an independent waterproofing layer to exist behind the rainscreen insulation, between that and the structural wall (or for it to form the outside layer of the structural wall itself).

**THERMAL PERFORMANCE**

Building Regulations set the standards and guidelines for the thermal insulation required within wall constructions for both new build and refurbishment projects, with thermal insulation performance expressed as a U-value.

The required U-value will depend on the location of the project (England, Scotland, Wales) and type of building (domestic, non-domestic). The requirements for the conservation of fuel and power, which includes thermal insulation, in buildings in England are detailed in Approved Documents (AD) L1A, L1B, L2A and L2B to the Building Regulations 2013 which came into effect on 6th April 2014.

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Details show typical wall constructions, whilst the diagram visualizes the insulation thicknesses required to meet commonly required U-values. The effect of thermal bridging associated with the multiple layers and associated through-connections (as noted) has been accounted for, based on certain common assumptions.

Point transmittance value of components have all been calculated in accordance with BR 443. The examples shown are typical but not exhaustive and Booth Muiries Design Team can advise on specific thermal specifications should they be required.
REFURBISHMENT

Modern methods of construction and innovative materials can transform tired and outdated buildings into attractive and inspiring spaces. Refurbishing buildings rather than demolishing and rebuilding them offers many significant benefits.

Refurbishment projects generally cause less disruption to the community and can dramatically improve the aesthetics of a building and the surrounding environment. In addition to the social benefits, refurbishments can make financial sense, even when the complete building envelope needs replacing. The majority of the building fabric can be retained, saving a significant amount of time and money. In addition, by reusing the functioning parts of the building, the impact on the environment is lowered with material production and transport being greatly reduced.

Metal composite materials, incorporating ACM, are proving to be increasingly popular for use in refurbishment projects as they are light, strong and durable, putting less strain on the building structure than heavier options. ACM can provide a mirror-like smoothness and can appear flatter than glass. It can be produced in a range of colours and can provide excellent colour consistency, offering architects design freedom which other materials cannot deliver.

1. Boston Building, Swan Street, Glasgow.
   Commercial office refurbishment.

2. The Atrium, home to the Cardiff School of Creative and Cultural Studies, Cardiff.
   Refurbishment of a former telephone exchange.

3. The Agora, Ellen Street, Hove.
   Industrial to office conversion and refurbishment.
Engineered support systems

A comprehensive range of engineered rainscreen support systems is available to suit all BML façade panel systems. All support systems have been designed with simplifying the installation process in mind. They generally consist of discrete wall brackets and extruded aluminium rail profiles that combine in various guises to form comprehensive and cost effective fixing systems for use with BML facade products or any other type of rainscreen.

Inconsistencies in the line and level of the substrate to which the façade is being attached are easily overcome due to the adjustable nature of the Smart Fixing System support grid. This adjustability facilitates a flawless installation of façade panels every time. All support systems are designed for rapid installation and simple alignment. Each is suitable for new build or renovation projects.

BML Smart Fixing Systems feature:

- High strength brackets suitable for a range of substrates
- Extruded aluminium rail profiles selected to suit the structural and dimensional stability requirements of any particular project.

Optimal fixing of façade systems relies on the fixing system. Fixing systems are differentiated according to visible or concealed fastening and horizontal or vertical fixing.

BML range of Smart Fixing Systems include:

- A visible fixing system with rivets
- A visible fixing system with clamps
- A concealed fixing system for use with adhesive systems
- Concealed fixing systems for façade products.

All systems are manufactured in accordance with EN12020 and EN 755. BML Smart Fixing Systems can be used to support all types of rainscreen panels including:

- BML Façade panels
- High pressure laminates
- Fibre cement panels
- Polyester powder coated aluminium
- Timber/cedar planks
- Terracotta tiles.
Wall bracket ECF-B-S

Wall bracket ECF-B-S is used for vertical fixing on solid walls and features the following benefits:

- Wind pressure is passed directly to the structural wall
- Each ECF-B-S can be used for a fixed point or a sliding point
- The ECF-B-D is mainly used as an anchor point. It has high bearing capacity through construction height and two wall mountings
- Fastener spacing of 125mm for the ECF-B-D makes it possible to more easily fasten brackets to problematic substructures
- Integrated clamp-side provides 40mm of adjustability in conjunction with L or T profiles
- Made of aluminium EN-AW 6060 T68.

<table>
<thead>
<tr>
<th>Bracket height (mm)</th>
<th>Rail length (mm)</th>
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<td>220</td>
<td>222 – 241</td>
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<td>255</td>
<td>257 – 276</td>
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</table>

5mm added if thermal pads are used.
Fixing systems are differentiated according to visible or concealed fasteners and horizontal or vertical fitting.

SYSTEM BASICS

Vertical systems

Vertical systems are used for mounting on solid walls. The primary profile is mounted vertically on an ECF-B-S.

Thermal linear expansion

When mounting vertical or horizontal systems, temperature-related linear expansion of the profiles must be taken into consideration. For this reason, the elongated holes of the wall brackets allow for thermal expansion of the section. The length of the profiles is determined by the height or panel separation.
**FIXING POINTS**

**Fixed point**

The fixed point passes the dead weight and wind loads to the load-bearing wall. The connection between the wall bracket and profile is therefore immovable.

For connections of primary carrier rails, both the fixed and sliding points can also be used for fastening the rails to the brackets.

**Sliding point**

In contrast, the connection between the wall bracket and profile at a sliding point needs to allow movement therefore the elongated holes are used for such connections. As a result, the profile is not impeded in the event of length changes and there are no jammed connections. For a sliding point, only wind pressure loads are passed to the load bearing wall.

**Thermal separation**

In order to avoid thermal bridges and to minimise heat loss, thermal separation elements are built in between the wall bracket and the outside wall.
FACE FIXING SYSTEMS

Visible fixing with rivets

Facade fastening with rivets is a very economical method of installation. It can be used for metal, fibre cement and high pressure laminate facade elements.

Visible fixing with clamps

Fastening by means of clamps is used in particular for ceramic and terracotta facade elements. The clamps are available in aluminium and stainless steel and can be made to match the colour of the facade elements.
**Concealed fixing with adhesive system**

Gluing façade panels is an economical mounting method. The panels are assembled on the properly pre-treated profiles with permanent elastic glue and double-sided adhesive mounting tapes.

**SYSTEM SUPPORT**

**Engineering support**

BML Smart Fixing Systems simplify the complexity of façade design. The optimal fixing solution can be determined based on the substrate, panel type and materials used. The bespoke static calculation programme ensures compliance with safety requirements and optimises the amount of fixing elements that need to be used. This results in the most efficient and effective supply of support fixings.

Installation plans are prepared and provided for clear communication of the correct rail and bracket layouts and connection methods to the installation teams.

By maintaining an open dialogue with customers, difficulties and possible improvements can be advised and suggested at the planning stage to help save costs. CAD drawings and system details can be provided as well as the appropriate templates for the specification. Architects are advised with regard to general and specific themes of rainscreen, and customers and installation teams can be trained at our dedicated training centre or onsite.

**Guarantee**

All systems are manufactured in accordance with EN12020 and EN755 and are statically provable. Booth Muirie is not liable for deficiencies in the installation. Building regulations must be met.
Booth Muirie offers a complete system with single source supply of all components, making it a quick, complete, economic and convenient solution.

**Fasteners and fixings**

A range of fasteners and fixings is available from Booth Muirie to suit any application, all of which are sourced from leading international manufacturers.

The choice of these components is tailored to the application, system and substrate to ensure optimal fixing, with components including:

- Insulation retaining fixings
- Panel support fixings
- System anchor fixings.

**Insulation**

A range of insulation types is available to suit taste and requirements. Mineral wool slabs and other insulation materials are all available.

**Fire stops**

The cavity between rainscreen façades and fire compartment walls/floors needs to be sealed with a fire stop, whilst allowing an air space for ventilation and drainage. Booth Muirie supplies fire stops from leading manufacturers to enable full compliance with building regulations.

**Tapes and sealants**

A range of high quality, cost effective tapes and sealants is available from Booth Muirie, all perfectly suited to specific applications.
1. Insulation retaining fixings
2. Firestop products
3. Insulation
4. Panel support fixings
5. System anchor fixings.
CASE STUDY: QUEEN ELIZABETH OLYMPIC PARK

Booth Muirie is an ideal partner for architects and designers of all types of ground-breaking new constructions. Exceptional technical ability and flexibility was required for the manufacture of the rainscreen cladding for the Olympic stadium and the resources available to Booth Muirie as a Euroclad company meant that this challenge could be met.

The London 2012 Games were the catalyst for transforming 2.5Km² of land into a fully functional, exceptional Olympic Park. What was once industrial, contaminated land was rapidly transformed over a three-year period. For the iconic and enduring Olympic Stadium around 4,500m² of rainscreen facades were manufactured and supplied. The size of panels and the type of installation presented considerable technical challenges, with the proposed manufacturing solutions forming part of the successful bid by specialist contractor Prater.

The system consists of vertical hook-on panels fixed at a 40° incline, which results in the panels being closer to the steelwork at the bottom than at the top. This required the construction of a full-size test rig at Euroclad headquarters to trial the handling, transport and fixing of the system. The panel lengths were longer than any that have ever been produced using ACM; posing significant challenges to ACM manufacturer Mitsubishi, which had to produce 7.8m long sheets; the longest ever made.

Both black and white panels were installed, with varying module widths and gloss levels of 30% and 80%; the aim being to create a barcode-like effect. The different gloss levels provide variety to the finished panels, which would otherwise appear monotonous. Panels were also installed on the VIP stair cores to provide an impressive finish.
1. A full-size test rig was built to ensure the record breaking panels could be transported, handled onsite and fixed without problems.

2. Left to Right: Olympic Gold medallist Lynn Davies, Managing Director Phil Cook and former ODA Chairman John Armit get a close-up view of the huge panels for the Olympic Stadium.

3. Olympic Stadium – manufacturing machinery was transformed to cope with the World’s longest sheets of Alpolic material and a full size rig constructed to test handling, transport and application.

The 80,000-seat stadium cost £496m to construct and was designed and constructed by ‘Team Stadium’ consisting of Populous, Sir Robert McAlpine and Buro Happold, with landscape designer HED and planning consultant Savills Hepher Dixon.

Now repurposed, the stadium has a long-term future to match its illustrious past and Booth Muirie has supplied additional panels to help achieve the redevelopment of the stadium, as new home to West Ham Football Club.
With diverse manufacturing capabilities, which include in-depth engineering skills and innovative, pro-active problem solving capabilities, Booth Muirie was the ideal partner for the challenging O2 Arena perimeter.

The transformation of the former Millennium Dome into the O2 Arena cost £500 million and is a key example of Booth Muirie’s exceptional technical ability. It was designed by HOK Sport and constructed by Sir Robert McAlpine, with specialist roofing contractor WWR employed to install the roof and the perimeter bullnose.

Presented as Euroclad Facades at the time, Booth Muirie took on the contract for the bullnose feature on a design and supply basis, appointing Buro Happold to assist with the analysis of the complex geometry. A strategy was developed by a team working together to provide the optimum solution for the bullnose structure, which was installed around the 468m perimeter of the roof.

The feature detail was ultimately realised by manufacturing 95 individual five metre assemblies, each formed from 73 cold-formed galvanised steel components.
These were finished with 760 individual ACM skin elements, which combined to create the final bullnose geometry.

Installation of this structure was an intricate operation; the galvanised assemblies were built at the factory in Cardiff and transported to site where they were attached to the primary steel work at 10m from ground level. The Alpolic skins were then installed before the whole structure was lifted into its final position 40m above the ground.

ACM was chosen for this application due to its flatness, light weight, rigidity and impact resistance; all characteristics of the unique composite construction of metal skins bonded to a mineral core.
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CASE STUDY: SOUTH GLASGOW UNIVERSITY HOSPITAL

Glasgow’s new University Hospital has been fitted with over 17,000m² of Booth Muirie’s innovative rainscreen cladding systems. The flexible BML Systems were used to create a number of colourful pods, which frame private patient rooms within the new children’s atrium, as well as being used across the entire campus for other feature cladding, reflecting the vibrant, contemporary design scheme of the new hospital.

The £842m South Glasgow University Hospital is Scotland’s largest hospital, located in the southwest of the city. Built to replace the previous Southern General Hospital, the Royal Hospital for Sick Kids and Western and Victoria Infirmary, the new campus hosts a 1,109-bed adult unit and 256-bed hospital for sick children, as well as other wards and teaching facilities.

The new building has been designed to reflect a modern environment, moving away from the traditional ward-based hospital.

Booth Muirie’s BML200 system was specified in lemon, orange, yellow-green, red, signal and anthracite grey; offering a flash of colour to the interior of the new children’s atrium. The rainscreen system was used to surround large windows of the private, ensuite patient rooms, offering a light-filled room with an open view of the atrium. Built to extend from the wall, these rooms are a key design feature of the building and Booth Muirie’s variety of vibrant colours allow them to stand out within the building.

The rectangular ACM panels were vertically applied to the colourful pods in the children’s atrium, displaying a consistent and sleek surface. The BML200 system is a mechanically-fixed rainscreen with a joint width of 20mm, providing the desired ‘block’ appearance.

The flexibility of the BML200 system makes it a suitable material for this particular application, as it could be pre-shaped to the main body of the pod and be fitted around corners without the need for any additional joints. Booth Muirie’s BML200 system used on The Children’s Atrium provided the design flexibility in both material and system to enable such a creative and innovative application.
CASE STUDY: MILTON KEYNES LEISURE PLAZA

Booth Muirie’s specialist architectural rainscreen cladding has been used as part of the construction of Milton Keynes’ brand new leisure plaza. Over 5000m² of the company’s advanced BML rainscreen systems have been used to form the exterior of the new popular attraction, which includes a newly refurbished Planet Ice (home to Milton Keynes’ Lightning Ice Hockey team) and a brand new Morrisons supermarket.

The £40m development, designed to a BREEAM Excellent standard, has provided a new home for the local Ice Hockey team with an increased seating capacity for spectators, as well as an ice rink attraction for the public with a new bar area, café, and party function room. The plaza displays a brand new, contemporary entrance with colourful feature lighting, leading to a variety of bars and restaurants.

The new Morrisons supermarket and additional retail units were added to the complex to make it an improved attraction overall for visitors, having been developed to replace the previous leisure complex, which was in need of extensive refurbishment and new construction.

Lee Homewood, Project Director at Kovara Projects, commented “We are always happy to work with Booth Muirie as they produce high quality products and provide excellent service from concept design to post completion. It was a very complex project with over 5000 individual panels in various sizes, which were installed with restricted access and this is something that we overcame efficiently. Everyone involved was delighted with the end result and the project was handed over achieving all of the key performance indicators set out at the pre-order stage.”

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PROJECTS GALLERY

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Architect  LRK Architects
Main contractor  Morgan Sindall
Specialist installer  Hathaway
Development: Stonehenge Visitors Centre
Location: Wiltshire
Architect: Denton Corker Marshall
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