January 2022

GD39 SUSTAINABILITY AND DURABILITY OF METAL ROOFING AND CLADDING SYSTEMS

SECTION 8: COMPONENTS

8.1 Components

The main components of any metal building envelope system are the metal profiled roofing and cladding sheets, sandwich panels or rainscreen panels etc. which are covered in section 7. There are though several other types of components which are critical in creating and securing the system. This section gives an overview of the main types of components, commenting on their durability and use within a metal roofing, cladding or façade system.

8.2 Insulation

The primary function of insulation is to provide the thermal performance of a roof and wall construction. The most common form of insulation used in built-up metal roofing and cladding is glass or rock mineral wool quilt which is favoured due to its non-combustibility, lightweight, low thermal conductivity and ease of handling.

Mineral wool insulation is available in numerous formats (e.g., rolls and slabs, see figure 8.1), thermal conductivities and varying densities including dual densities. Rock mineral wool will have a typical density up to 200 kg/m^3 and glass mineral wool will have a typical density up to 80 kg/m^3. Higher density and dual density mineral wool insulation is generally used in rainscreen clad built-up wall systems.

Figure 8.1 – Rolls and slabs of mineral wool insulation

Higher densities of insulation can also be used to add increased mass to a metal roofing and cladding system to increase its sound reduction performance.

The sound absorption properties of mineral wool insulation can be used in conjunction with perforated metal liner and decking sheets to help reduce the reverberation time in an enclosed space such as sports arenas, classrooms etc.

Both glass and rock mineral wool insulation products can achieve a European Reaction to Fire Rating Classification of A1 (equivalent to non-combustible) as defined in BS EN 13501–1 making them ideal for fire wall systems as well as for standard built up systems. Fire wall systems require testing to BS 476-22 and must carry current certification.

As the insulation is installed as part of a system it has suitable durability to match the life of the metal roofing and cladding system. Provided the integrity of the roofing and cladding is maintained throughout the life of the system, maintenance of the insulation is not required. Mineral wool can be susceptible to issues of water absorption if it is subject to prolonged contact with water. Where insulation is being stored for any length of time, it must be protected from the elements and should be lifted clear of the ground.

It is good building practice to ensure that construction products are installed under the correct conditions and as such, prolonged exposure to the elements should be avoided and the insulation products should be installed in a dry state. Only lay out as much insulation as can be covered within the work period and before rain. Protect installed insulation at various details such as ridges and verges until covered by flashings. Verge insulation can be installed at the time of installing the flashings.

Roof insulation should not be walked on or compressed excessively as this will damage the fibres and will result in a loss of thickness and thermal performance. If insulation damage does occur, replacement material must be installed.

Further information on the installation of insulation can be found in MCRMA Guidance Document GD28 – *Mineral wool insulation installation: Best practice guide*

8.3 Spacer kits for metal roofing and cladding systems

The cavity for the insulation between the outer weather sheet and liner/decking sheet of a built-up metal roofing and cladding system is created by a spacer kit. This can be in several formats depending upon the top sheet utilised and the depth of cavity required. The main types are as follows but other combinations and variations do exist.

- Full cavity depth standard and enhanced bracket and bar systems typically incorporated with a trapezoidal profile top sheet or a secret-fix profile outer sheet, see figure 8,2.
    - Material is predominantly galvanised mild steel although stainless steel can be supplied. A plastic or foam barrier pad is usually installed on the base of the bracket.

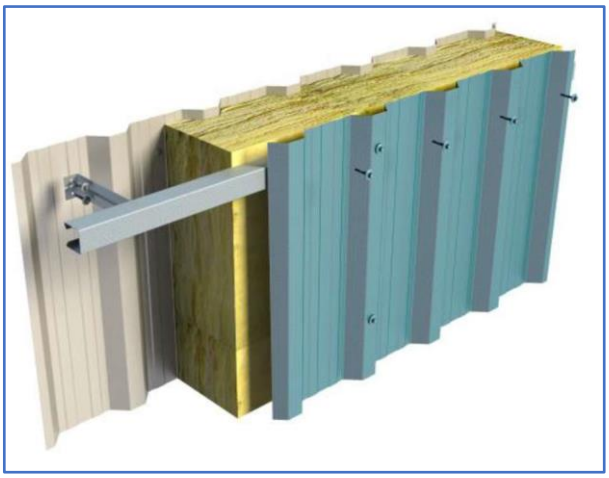


Figure 8.2 – Bracket and bar spacer system

- Full cavity depth halter incorporated with a standing seam profile top sheet.
    - Material is extruded aluminium although stainless steel and plastic variants are increasingly becoming used because of their lower thermal conductivity. A plastic barrier pad is usually installed on the base of an aluminium halter.
    - Maximum cavity depth for a halter system is approximately 200 mm. For roof system depths greater than this the halter can be used with a bracket and bar system (see figure 8.3), or on a top-hat profiled sub-purlin.
    - Top-hat profiled sub-purlin is predominantly galvanised mild steel although aluminium can be supplied specially when used with perforated liner/decking sheets in aggressive internal environments e.g., swimming pools.

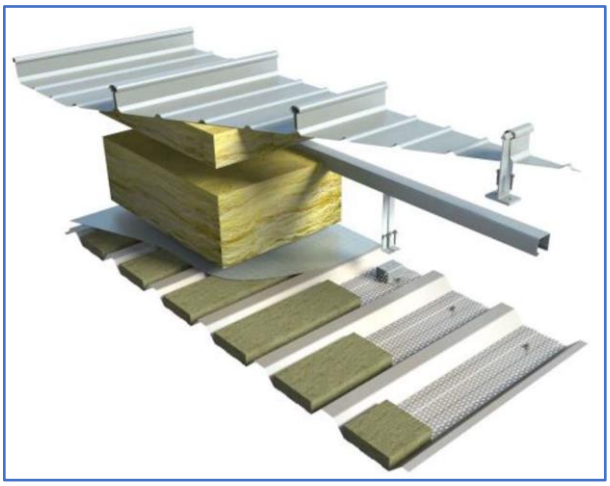


Figure 8.3 – Halters used with bracket and bar spacer system

As the spacer kit is installed as part of a system it has suitable durability to match the life of the metal roofing and cladding system. Provided the integrity of the roofing and cladding is maintained throughout the life of the system, maintenance would not be required.

Where the spacer kit is partially exposed e.g., in use with perforated liner/decking sheets and where corrosive conditions are expected in the cavity around the spacer, the materials for the spacer kit and its fasteners should be selected that are resistant to the corrosion for the design life of the roofing and cladding system. In these circumstances, advice should be sought from the manufacturer/supplier of the metal roofing and cladding system.

8.4 Rainscreen cladding support systems

Rainscreen cladding support systems consist of several components, the main ones being brackets and rails, which form a-sub-frame that connects the rainscreen cladding panels to the structural backwall, see figure 8.4. The size of the bracket projecting from the wall will depend on the thickness of insulation and cavity size.

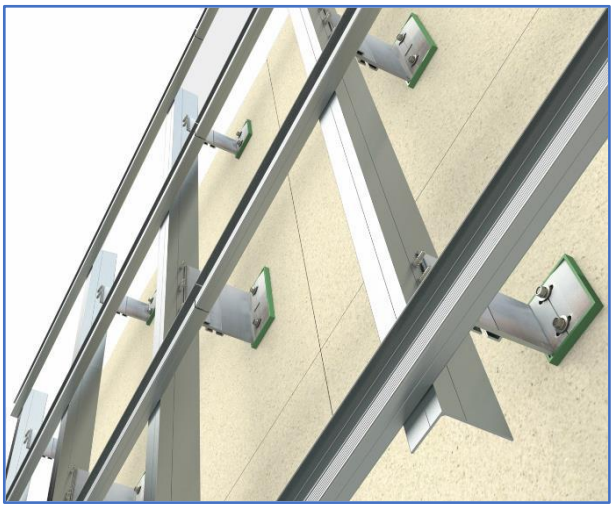


Figure 8.4 – Proprietary rainscreen cladding support system

The support system and its fasteners need to consider a number of factors, including the loads that need to be carried; the need for adjustability for the cladding system and building tolerances; thermal movement of cladding materials; building movement and sway etc.

As rainscreen support systems are both hidden from view and exposed to atmospheric conditions e.g., within a ventilated and drained cavity, it is essential they are manufactured from durable and corrosion resistant materials. Rainscreen cladding support systems are predominantly produced from extruded aluminium sections, although there are systems which are fabricated from stainless steel.

Fasteners connecting framing components (bracket and rails) should be stainless steel, typically austenitic grades (see 8.5 below), although care must be taken to isolate large stainless steel fixings from aluminium components. Suitable isolating materials are nylon or plastic/rubber polymer products.

Several proprietary aluminium rainscreen cladding support systems are covered by BBA certificates which indicate that can be expected to have a service life in excess of 35 years in normal UK conditions.

Unprotected aluminium needs to be protected from direct contact with cementitious materials to prevent corrosion. Proprietary aluminium brackets are generally supplied with polypropylene or PVC thermal isolator pads, which should be used when brackets are connected to masonry walls.

Further information can be found in MCRMA Guidance Document GD08 – *An introductory guide to rainscreen support systems* and MCRMA Guidance Document GD11 – *Fixings and fastenings for rainscreen systems.*

8.5 Fasteners

Metal roofing and cladding systems rely upon mechanical fasteners to secure the system to the structure. The importance of the correct selection of the type of fastener and the material from which it is produced is critical in terms of providing the required service life for the given application of the metal system for which it is a key component.

Fasteners can be broken down into two basic types, primary and secondary, see figure 8.5:

- Primary fastener
    - A fastener that secures profiled sheeting, sandwich panels, spacer kits, support systems etc. to the supporting structure either direct or via other support.
    - Primary fasteners are used to transfer all the loads (e.g., dead, imposed, wind, thermal etc.), acting on the metal roofing and cladding system back to the supporting structure and are therefore relied upon for their structural performance.
- Secondary fastener
    - A fastener that secures the laps of profiled sheets to each other but not to the supporting structure. For metal cladding systems, secondary fasteners are typically used for sheet side lap stitching and the securing of flashings and ancillary components to the sheeting.

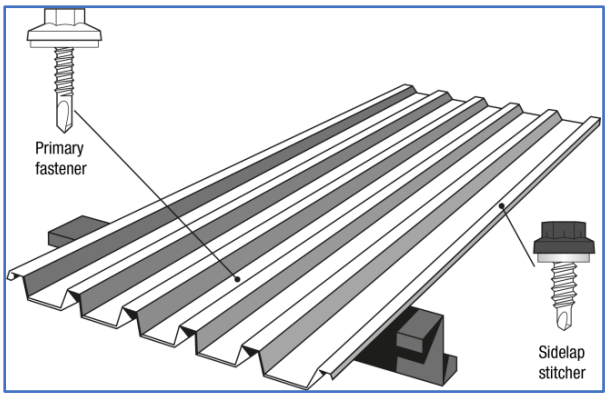


Figure 8.5 – Primary and secondary types of fastener

- Unlike primary fasteners, secondary fasteners are not generally relied upon for structural performance, however, they must be capable of providing a secure fixing.

Primary and secondary fasteners are usually threaded, either ‘self-drilling’ which have an integral drill point or ‘self-tappers’ which require a pre-drilled pilot hole prior to installing the fastener. Non-threaded fasteners, such as rivets are mainly used in secondary fastener applications but may also be suitable in some primary fastener applications e.g., fixing top-hat sub-purlin spacer to structural decking sheet.

A fastener must have a level of durability compatible to the design life of the metal roofing, cladding or rainscreen system and the atmospheric environment, both external and internal it is installed in. Fasteners are available in a range of materials (coated carbon steel, stainless steel and aluminium) all of which offer different levels of corrosion resistance/durability when exposed to a variety of conditions.

Coated carbon steel fasteners have been shown to be suitable where there is not the risk of corrosive internal and external environments and where the functional life expectancy, not a warranty, required of the fastener and cladding system does not exceed approximately 25 years. External/exposed coated carbon steel fastener heads should be protected from low corrosion-risk external environments by factory ‘colouring’ or integral plastic heads to provide this functional life. They should not be used with aluminium, stainless steel, copper or zinc sheeting or components unless the fasteners are used internally, and the internal conditions are limited to C1 – very low and C2 – low corrosivity categories (see table 4.2 in Section 4).

Where functional life expectancies, and warranties, exceed 25 years, stainless steel is the material generally recommended for fasteners for use with metal roofing, cladding and rainscreen systems in most applications. However, the durability in any particular environment will be dependent on the grade of stainless steel specified. Austenitic stainless steel grade EN 1.4301 (A2, 304) is generally suitable for corrosivity categories C1 – very low, C2 – low and C3 – medium, whilst austenitic stainless steel grade EN 1.4401 (A4, 316) is generally suitable for all corrosivity categories with the possible exception of C5-M – very high (marine) and internally in swimming pools where high molybdenum grades of austenitic stainless steel such as EN 1.4529 and EN 1.4547 may be required.

Aluminium fasteners are highly durable but their use with metal roofing, cladding and rainscreen systems is very limited. Aluminium threaded fasteners cannot be used in conjunction with steel purlins, spacers or cladding as the aluminium does not have sufficient hardness to drill or thread form into steel. Their main applications as primary fasteners are for securing aluminium profiles to timber supports and also as secondary (stitching) fasteners within aluminium profiles.

The metal roofing, cladding and rainscreen system manufacturer/supplier and fastener manufacturer should always be consulted as to the most suitable fastener for a given application.

Further information on fasteners for metal roofing and cladding systems can be found in MCRMA Guidance Document GD 33 – *Fasteners for metal roofing and wall cladding: Design, detailing and installation guide* and for rainscreen systems in MCRMA Guidance Document GD11 – *Fixings and fastenings for rainscreen systems.*

8.6 Profiled fillers

Profiled fillers are used to close off gaps at junction details in metal cladding and roofing systems e.g., at ridges, verges, eaves, cills etc. They are generally positioned between the profiled sheet and the junction detail flashing. Profiled fillers are also available in a notched or 'ventilated' format, see figure 8.6, to allow ventilation to the detail. Although not the primary weather seal at the detail they close off cavities to prevent ingress of rainwater, snow, dust, debris, birds etc. To discourage potential attack from birds they should be positioned a minimum of 80 mm back from the sheet/flashing edge.

Figure 8.6 – 'Ventilated' profiled ridge filler prior to installation of ridge flashing)

There may be a need to seal profiled fillers with an appropriate sealant at some details and the advice and recommendations from the roofing and cladding systems manufacturer/supplier should be followed.

Profiled fillers are manufactured from several flexible closed-cell materials which have differing life expectancies. Typical materials (with approximate durability which would be depending upon conditions) include:

- Polyethylene (fully closed cell cross linked PE) = 20 years
- EPDM (fully closed cell EPDM) = up to 25 years
- Metallocene Polyolefin (fully closed cell metallocene catalysed polyolefins) = 25 + years

The filler type should be chosen that best suits the design life of the building system. Filler materials should have high resistance to UV attack but may be protected further from direct exposure by their positioning in the detail, see above, or the use of metal closures or 'toothed' flashings as part of the detail.

Details should be checked during periodic roofing and cladding inspections for any signs of missing, displaced, damaged (i.e., from birds) and degraded profiled fillers and replaced as soon as possible.

8.7 Sealants

The main use of sealants in metal roofing systems is at end and side lap positions between profiled metal to profiled metal (see figure 8.7) or profiled metal to profiled rooflight combinations. Other uses would be at penetrations, junction details, flashing joints etc.

At end and side lap positions the sealants would not generally be considered replaceable as part of any routine maintenance therefore their durability ideally needs to match the design life of the metal roofing and cladding system.

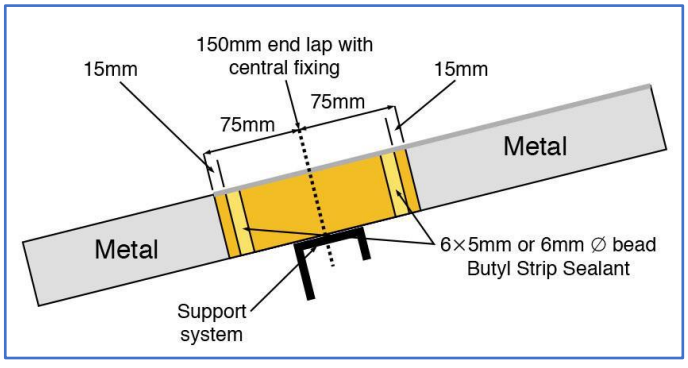


Figure 8.7 – Typical metal to metal sheet end lap with sealant

Butyl strip sealants are recommended for use at metal roofing lap positions.

Butyl is a blend of synthetic rubber plasticisers with fillers and resins and is extruded in strips of various sizes and shapes. The durability of butyl strip sealants is typically 25 years for a "higher performance" class A sealant in accordance with the National Federation of Roofing Contractors (NFRC) Technical Bulletin 36 – *Performance standards of building strip sealants in metal clad buildings*.

The effective sealing of end lap configurations using butyl strip sealant is a careful balance between the size of the butyl strip sealant, the proximity of the sealant relative to the primary fixings and the number and positioning of the primary fixings. Inadequately sized or positioned sealant, and/or insufficient or incorrectly positioned fixings, will result in poor sealing of the end lap detail. Further information on end lap sealing of metal roofing systems can be found in MCRMA Guidance Document GD19 – *Effective sealing of end laps in metal roofing constructions*.

8.8 Membranes

Membrane materials used in metal roofing, cladding and rainscreen façade systems are used as vapour control layers (VCLs) or breather membranes.

8.8.1 Vapour control layers (VCLs)

In insulated roofing, cladding and rainscreen façade systems a vapour control layer (VCL) is required to restrict the movement of water vapour from inside the building into the construction, thereby minimising the risk of condensation. The VCL, which can also be used to minimise air permeation through the construction, should always be positioned on the warm side of the insulation and be continuous and fully sealed at all laps, perimeters, penetrations etc.

Metal liners of a built-up roofing and cladding system can be sealed to form an efficient vapour control layer in most applications.

In rainscreen built-up constructions and in some metal and cladding systems, in particular those with decking and perforated liner/decking based systems, a separate fully sealed flexible VCL membrane is required, see figure 8.8. This membrane would usually be produced from polyethylene, ideally mesh reinforced (for strength and tear resistance) and which may incorporate an aluminium foil. A VCL should have a minimum vapour resistance of 200 MN/g,

With perforated metal liner and decking systems which include a layer of mineral fibre insulation below the VCL the ratio of insulation above the VCL to that below should be a minimum of 2 to 1. In high humidity applications such as in swimming pool environments this ratio may need to be increased (e.g., up to 5 to 1). Ideally a condensation risk analysis should be carried out to ensure that the dew point does not occur within the construction on the cold side of the VCL.

Figure 8.8 – Mesh reinforced vapour control layer in a built-up acoustic roof system with perforated decking)

As VCL membranes are installed as part of a system they have suitable durability to match the life of the metal roofing, cladding or façade system. Provided the integrity of the metal roofing, cladding or façade system is maintained throughout the life of the system, maintenance of the VCL would not be required.
The VCL membrane should ideally be installed and sealed in dry conditions. Any damage to the membrane should be repaired or the membrane replaced in that location.

Where the VCL maybe partially exposed e.g., in use with perforated liner/decking sheets and where corrosive conditions are expected, a VCL membrane should be selected that is resistant to the corrosion for the design life of the roofing, cladding or façade system. In these circumstances advice should be sought from the manufacturer/supplier of the system.

8.8.2 Breather membranes

Breather membranes are rarely ever used in double skin insulated built-up metal roofing and cladding systems but are commonly incorporated as part of a rainscreen built up wall system.

A breather membrane is usually positioned within the ventilated cavity on the outside of the insulation, see figure 8.9, and its general purpose is to protect the outer surface of the mineral wool insulation layer from water penetration whilst allowing any water vapour from inside the construction to pass through it.

Breather membranes are typically flexible sheets made from a wide variety of materials e.g., multi-layer laminated polyolefin, polypropylene etc. with a very low vapour resistance. CWCT Technical Note 33 - *Breather membranes and vapour control layers in walls* indicates that breather membranes should have a vapour resistance less than 0.6 $MNsg^{-1}$.

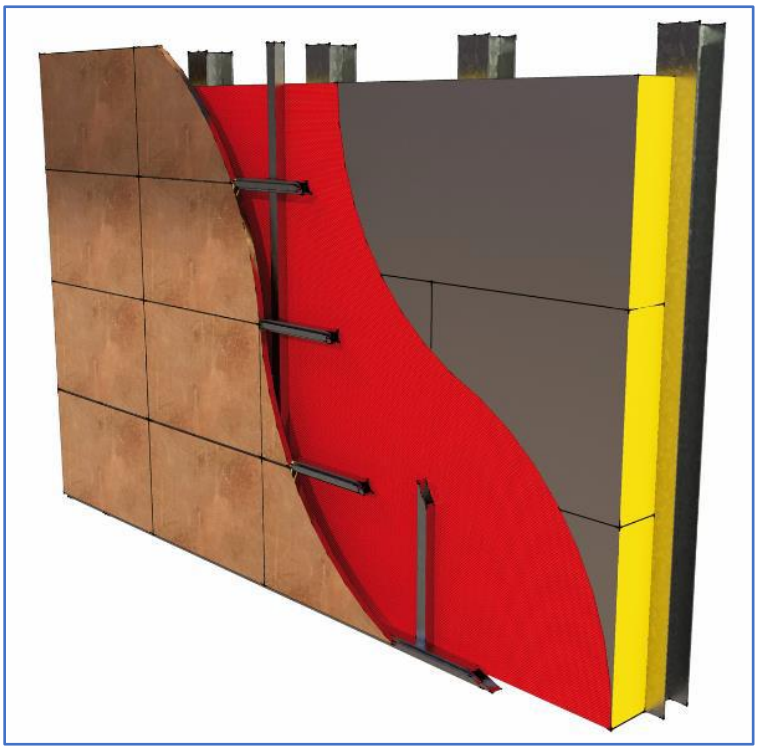


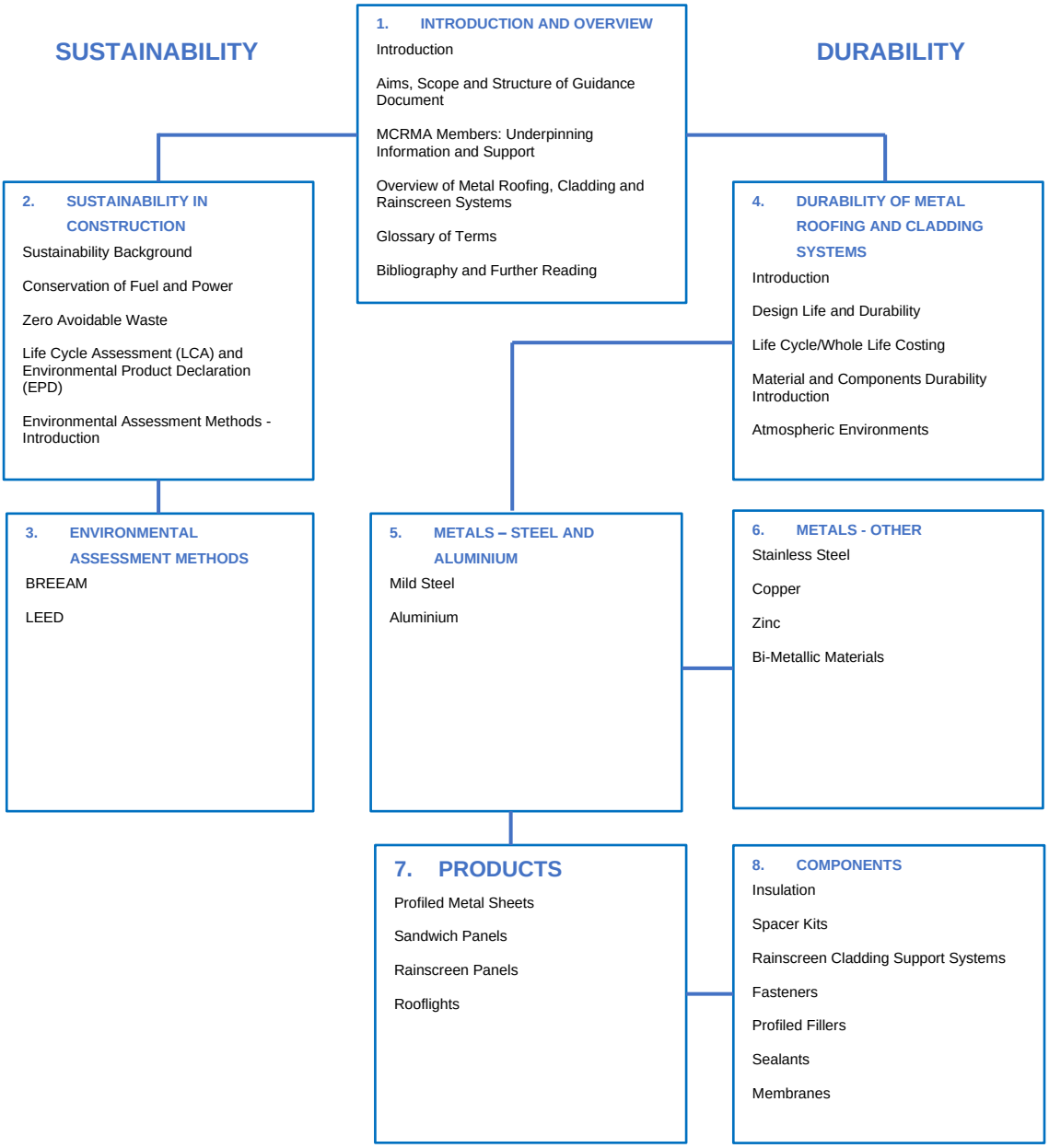
Figure 8.9 – Breather membrane positioned within ventilated cavity on outside face of insulation

To function as intended the breather membrane should be continuous and fully sealed at all laps, perimeters, penetrations etc. especially around rainscreen support bracketry.

As breather membranes are both hidden from view and exposed to atmospheric conditions e.g., within a ventilated and drained cavity, it is essential that a breather membrane is selected that is resistant to any corrosion or degradation for the design life of the rainscreen cladding system in the given application. Advice should be sought from the manufacturer/supplier of the system.

The breather membrane should ideally be installed and sealed in dry conditions. Any damage to the membrane should be repaired or the membrane replaced in that location.

8.9 STRUCTURE OF GD 39



Pictorial overview of MCRMA guidance document GD39: Sustainability and durability of metal roofing and cladding systems

8.10 GLOSSARY OF TERMS

BRE Green Guide to Specification Generic product LCAs and EPDs form the basis of the BRE (Building Research Establishment) Green Guide to Specification (Green Guide). Initially published as a simple to use 'green guide' to the environmental impacts of common building materials and products. It has undergone regular updates and expansion as an online version which provides guidance for specifiers, designers and their clients on the relative environmental impacts of many elemental specifications for roofs, walls, floors etc.

BREEAM (Building Research Establishment Environmental Assessment Method) A voluntary scheme which can be used to assess the environmental performance of most types of building (new and existing). Developed by BRE (Building Research Establishment) it is the world's longest established environmental assessment system and is used internationally as well as in the UK.

COP (Conference of the Parties) 26 The 26th Meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). The COP26 conference was held in Glasgow in November 2021 hosted in partnership by UK and Italy. Previous notable COP conferences took place at Kyoto (COP3) in 1997 and Paris (COP21) in 2015. These and other conferences have led to commitments to climate change, reduction of greenhouse gases and keeping global temperature rise this century below 2°C (preferably 1.5°C) above pre-industrial levels have been agreed.

CSR (Corporate Social Responsibility) The self-regulated responsibility of companies to society in areas such as the environment, the economy, employee well-being etc. Most companies, especially larger ones, now report on their CSR, a major element of which is the carbon footprint of a company's activities and their efforts to reduce it.

Environmental assessment method/rating system A methodology and/or rating system where various environmental impact factors are assessed against given criteria and points/credits are awarded. The total number of points/credits obtained will provide an indication of the environmental friendliness of a building design and its operation. The use of environmental assessment methods and rating systems can help encourage clients, developers and design teams to design and construct more sustainable buildings which are more energy efficient, climatic responsive, material and resource efficient, have healthier indoor environments for occupants and limit waste emissions and pollution.

EPD (Environment Profile Declaration) The results of an LCA are published in an EPD which is developed to a common format e.g., to the principles and procedures given in ISO 14025. The overall goal of an EPD is to communicate verifiable and accurate information on the environmental aspects of products that are not misleading. An EPD also provides the basis of a fair comparison of the environmental performance of products.

Greenhouse Gases Greenhouse gas emissions from human activities strengthen the greenhouse effect, causing climate change. Some of the gases occur naturally in the atmosphere, while others result from human activities. The seven greenhouse gases which contribute directly to climate change are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). The largest contributor to global warming is carbon dioxide (CO_2) which makes it the focus of many climate change initiatives.

LCA (Life Cycle Assessment) An assessment of the environment impacts of a product over its life cycle to a given methodology e.g., compliance with ISO 21930, considering several environmental issues. This life cycle of the product is often referred to as '*cradle to grave'*, where the *'cradle'* is the extraction of raw materials and the *'grave'* is the product's disposal and will consider the product's use over the building's life expectancy. A variation is a '*cradle to cradle'* life cycle where the disposal stage is replaced with a recycling process that produces material suitable for manufacturing a new product. LCAs are often broken down further into '*cradle to gate*' and '*gate to gate*' life cycles which can be useful for a manufacturer as a means of identifying internal processes for environmental improvements.

LCC (Life Cycle Costing) An LCC will consider all relevant costs over the defined life of a building covering construction costs, operation and occupancy costs, maintenance costs, renewal costs, and end of life costs as well as any environmental costs.

LEED (Leadership in Energy and Environmental Design) Green Building Rating System A voluntary, standard for developing high-performance, sustainable buildings developed by the US Green Building Council (USGBC). Although developed in and for the USA it is used internationally including the UK.

NDC – Nationally Determined Contributions National action plans on how countries will meet their commitments to climate change, reduction of greenhouse gases and rise in global temperature.

Net Zero Carbon/Net Zero Total greenhouse gas emissions going into the atmosphere e.g., from a particular process are equal to (or less) than the removal of greenhouse gases out of the atmosphere.

WLC (Whole Life Costing) A WLC will cover all the costs in an LCC as well as non-construction costs and incomes.

ZAW (Zero Avoidable Waste) The prevention of waste being generated at every stage of a project's lifecycle, from the manufacture of materials and products, the design, specification, procurement and assembly of buildings and infrastructure through to deconstruction. At the end of life, products, components and materials should be recovered at the highest possible level of the waste hierarchy, whilst ensuring minimal environmental impact.

8.11 BIBLIOGRAPHY AND FURTHER READING

The following is a list of support documents and publications that were used in the development of this guidance document, and which will provide further reading on the subject.

Approved Document B Volume 2 – *Buildings other than dwellinghouses – Fire Safety (for use in England)*

Aurubis – *Copper Book for Architecture*

BES 6001 – *BRE Framework Standard for Responsible Sourcing*

BRE BR502 – *Sustainability in the built environment: An introduction to its definition and measurement*

BRE Digest 489 – *Wind loads on roof-based photovoltaic systems*

BRE Information Paper IP 13/10 – *Cool roofs and their application in the UK*

BREEAM – *BREEAM UK New Construction – Non-domestic Building (United Kingdom) – Technical Manual – 2014*

BREEAM – *BREEAM UK New Construction – Non-domestic Building (United Kingdom) – Technical Manual - 2018*

BS ISO 15686-5:2017 – *Buildings and constructed assets. Service life planning. Life-cycle costing*

BS 7543:2015: *Guide to durability of buildings and building elements, products and components*

BS EN 1990: 2002+A1: 2005 (incorporating corrigenda December 2008 and April 2010) – *Eurocode – Basis of structural design*
NA to BS EN 1990: 2002+A1: 2005 (Incorporating National Amendments No.1) – *UK National Annex for Eurocode – Basis of structural design*
BS EN 15804: 2012+A2:2019 (incorporating corrigenda February 2014 and July 2020) – *Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products*
BS EN ISO 14001:2015 – *Environmental management systems. Requirements with guidance for use*
BS EN ISO 9001:2015 – *Quality management systems. Requirements*
BS EN 14782:2006 – *Self-supporting metal sheet for roofing, external cladding and internal lining. Product specification and requirements*
BS 5427:2016+A1:2017: *Code of practice for the use of profiled sheet for roof and wall cladding on buildings*
BS EN ISO 12944-2 *Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments*
BS 476-22:1987 – *Fire tests on building materials and structures. Part 22: Method for determination of the fire resistance of non-loadbearing elements of construction*
BS EN 506:2008 – *Roofing products of metal sheet. Specification for self-supporting products of copper or zinc sheet*
BS EN 1172:2011 – *Copper and copper alloys. Sheet and strip for building purposes*
BS EN 988:1997 – *Zinc and zinc alloys. Specification for rolled flat products for building*
BRE – *BRE Building Elements: Roofs and roofing: Performance, diagnosis, maintenance, repair and the avoidance of defects - Third Edition*
BSSA – *Stainless Steel and Sustainable Construction*
CAB – *Aluminium & sustainability: a 'cradle to cradle' approach*
CLC/GBC – *Zero Avoidable Waste in Construction*
CLC/GBC – *The Routemap for Zero Avoidable Waste in Construction*
Constructing Excellence – *Sustainable Construction: An Introduction*
Constructing Excellence – *Whole Life Costing*
CP 143-5:1964 – *Code of practice for sheet roof and wall coverings. Code of practice for sheet roof and wall coverings. Zinc*
CPA – *COP26 – An Introduction*
CPA – *Net Zero Carbon – What on Earth does it mean?*
CPA - *A guide to understanding the embodied impacts of construction products*

CWCT Technical Note 33 - *Breather membranes and vapour control layers in walls*
CWCT – *Guidance on built-up walls*
Euro-Inox – *Technical Guide to Stainless Steel Roofing*
Euro-Inox – *Cleaning Architectural Stainless Steel*
Hydro – *Circular economy – the design perspective. From theory to implementation*
International Molybdenum Association (IMOA) – Which *stainless steel should be specified for exterior applications?*
ISO 21930:2017 - *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*
ISO 14025:2006 - *Environmental labels and declarations — Type III environmental declarations — Principles and procedures*
MCRMA Article – The factors to consider when installing PV panels
MCRMA Membership Charter
MCRMA Guidance Document GD01 – *Built up systems and spacer stability*
MCRMA Guidance Document GD08 – *An introductory guide to rainscreen support systems*
MCRMA Guidance Document GD11 – *Fixings and fastenings for rainscreen systems*
MCRMA Guidance Document GD12 - *Composite flooring systems: Sustainable construction solutions*
MCRMA Guidance Document GD17 – *A guide to site installation of insulated roof panels*
MCRMA Guidance Document GD19 – *Effective sealing of end laps in metal roofing constructions*
MCRMA Guidance Document GD21- *Thermal performance of buildings: non-domestic construction*
MCRMA Guidance Document GD22 – *Installing renewables on metal roofs: A checklist*
MCRMA Guidance Document GD28 – *Mineral wool insulation installation: Best practice guide*
MCRMA Guidance Document GD 33 – *Fasteners for metal roofing and wall cladding: design, detailing and installation guide*
MCRMA Guidance Document GD 34 – *The definition of cladding within the construction sector*
NARM Technical Document NTD09 2014 - *Rooflights: glass, polycarbonate or GRP?*
NARM Technical Document NTD15 2018 - *A guide to rooflights for profiled sheeted roofs*
NFRC – *Profiled sheet roofing and cladding – The NFRC guide to design and best practice (Blue Book)*
NFRC Technical Bulletin 36 – *Performance standards of building strip sealants in metal clad buildings*

RICS NMM3 - *New rules of measurement: Order of cost estimating and cost planning for building maintenance works*

RICS Guidance Note – *Life cycle costing*

UK Government – *COP26 Explained*

USGBC – *LEED v4 for Building Design and Construction*

USGBC – *LEED v4.1 for Building Design and Construction*

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