Approved Document B

standards

rainscreen

aesthetics

wind resistance

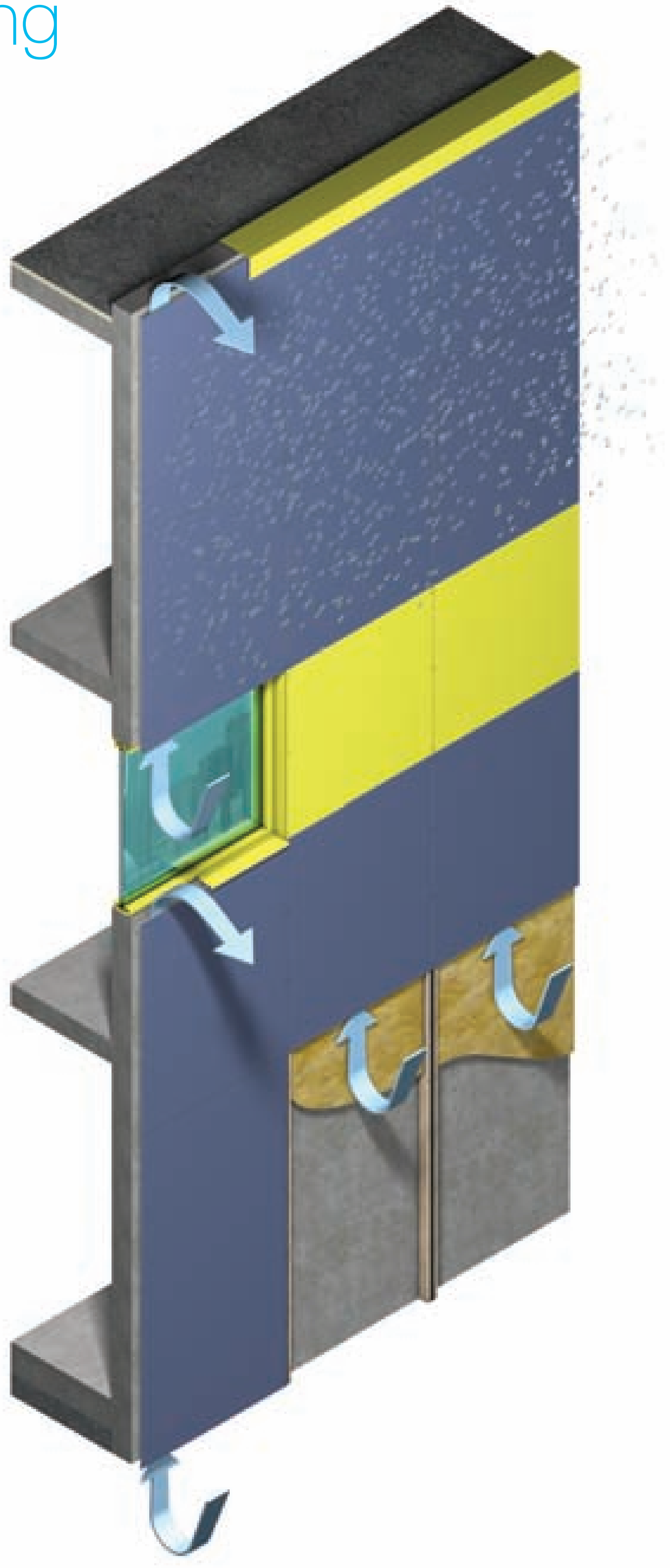
thermal performance

colour

Design considerations

Rainscreen cladding

Principles and benefits



The past

The rainscreen principle is not new, nor is the idea of rainscreen applied to wall design.

For centuries in Norway, drained and back-ventilated claddings were used with both closed and open joints but without any scientific, systematic foundation.

Gradually, on buildings with timber claddings, closed joints were adopted, and openings at both the top and bottom of the cladding allowed for drainage and evaporation of any penetrating rainwater.

By the 1980's, rainscreen was understood and widely used in Canada and Europe. Architects and specifiers have been using rainscreen systems, including those from Marley Eternit, for a wide range of building types across a number of sectors.

Rainscreen cladding

Today's rainscreen systems offer unique aesthetic and performance benefits:

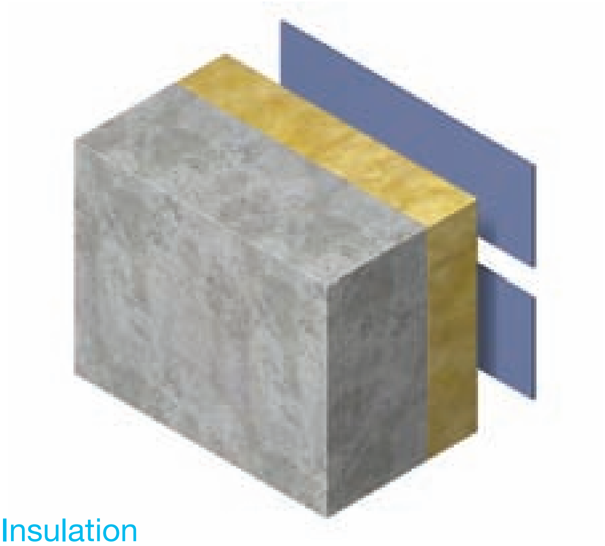
- Contemporary, crisp elevations
- The ability to 'overclad' existing buildings
- Excellent levels of thermal performance (when used with insulation)
- Improved acoustics for building users
- Excellent weather resistance

A special characteristic of the rear ventilated cladding system is its guaranteed performance. The system's effectiveness is maintained even when unfavourable internal or external atmospheric conditions are experienced, e.g. in the textile industry, swimming pools and breweries. No other wall construction is currently able to fulfil the growing requirements for heat, moisture, noise insulation, and fire protection.

The system works by the provision of ventilation openings at the base and top of the cladding area, avoiding any interruptions, windows and other openings. These openings are protected by mesh or purpose-made closures to prevent entry by birds, vermin or insects. Inlet and outlet gaps should be provided according to the following minimum.

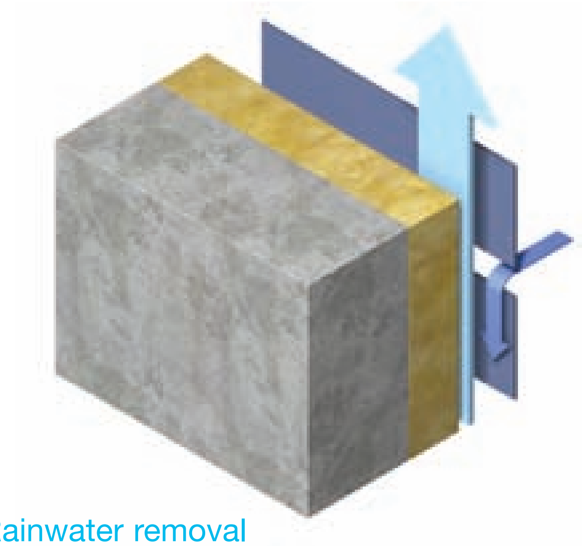
- Up to five storeys – 10mm continuous
- Five to fifteen storeys – 15mm continuous
- Above fifteen storeys – 20mm continuous

A clear minimum cavity of 30mm should be provided continuously behind the cladding panels. Any moisture penetrating the various joints in the main cladding screen will then be effectively removed by the provision of uninterrupted ventilation paths the full height of the cladding.



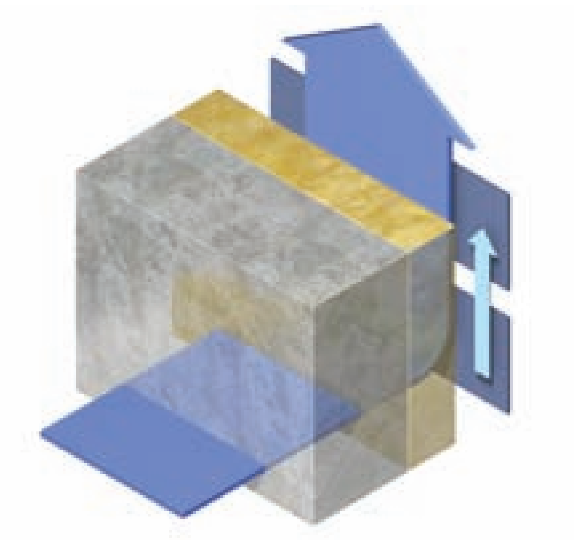
Insulation

- Insulation of up to 240mm thickness can be accommodated using a Marley Eternit framing system
- All types of insulation can be used – from rigid PUR to mineral wool
- Insulation positioned against substrate maximises heat retention and minimises condensation issues
- Externally located insulation maximises internal floor space
- Mineral wool insulation allows moisture to pass through to the cavity where passage of air evaporates it



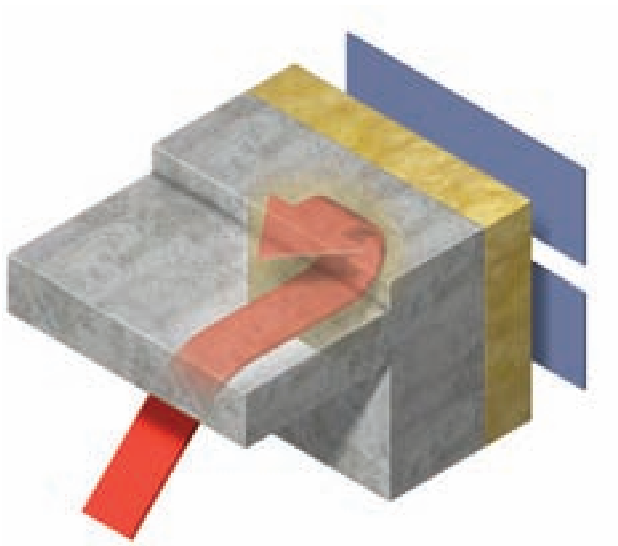
Rainwater removal

- Cladding prevents penetration of most rainwater
- Natural ventilation – stack effect – evaporates penetrating rain
- Residual rainwater drains harmlessly and evacuates at base of system
- Pressure equalised system naturally inhibits ingress of driven rain



Removal of interstitial condensation

- Thermally efficient system
- Any interstitial condensation kept to outside of structure
- Quickly removed via evaporation
- Structure maintained at even temperature
- Structure temperature kept above dew point



Minimisation of thermal bridging

- Continuous insulation envelope possible
- Insulation is external, so no thermal breaks required to accommodate internal structural elements such as floors and beams

Rainscreen and overcladding

The aesthetic, remedial and thermal solution

One of the key ways in which rainscreen can benefit existing buildings is through overcladding.

Apartment and office blocks, retail, healthcare and commercial establishments may well require both remedial and aesthetic work to make them suitable for today's environment.

On top of this, the thermal inefficiencies inherent in this legacy building stock will almost certainly need radically upgrading to meet today's exacting regulations.

Overcladding with rainscreen cladding systems achieves all three key requirements:

- Remedial
- Aesthetic
- Thermal (with insulation)

Other benefits

Minimising disturbance

Overcladding is carried out entirely from the outside, so there is usually minimal disruption.

Balconies

Balconies and walkways can be fully enclosed to create buffer zones. If external wall insulation is not considered then enclosing the balconies will also reduce the effect of the thermal bridges associated with them.

Vandalism

Those external wall surfaces prone to vandalism and graffiti – for instance, at ground floor level – can be clad with more suitable material or one such as Natura incorporating the UV Pro coating offering good protection against graffiti and subsequent removal.

Maintenance

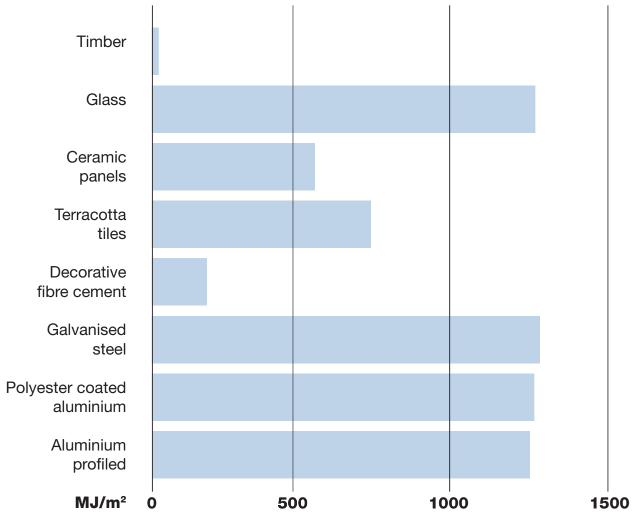
As a non-loadbearing extra 'skin', fixed to the substrate, maintenance or replacement of panels is straight-forward and non-invasive, as is access to the loadbearing structure i.e., columns, beams and slabs.

Building life

Whilst overcladding will not reinstate structural integrity of a building, it will, if designed and installed correctly, extend its life by improving weather resistance.

Embodied energy for cladding materials

The table below shows embodied energy for various cladding materials. Lower embodied energy will allow the designer to achieve a higher BREEAM rating.



Data from www.sustainingtowers.org/WALLSa.htm

Key features for overcladding

- Restoration of existing facade
- Extending the life of the building
- Improving appearance and image
- Provide thermal insulation and weather-tightness
- Improve acoustical performance of the building
- Lower maintenance cost

Natura, Atkinson's Store, Sheffield

Rainscreen and wall insulation

Providing thermal insulation for walls

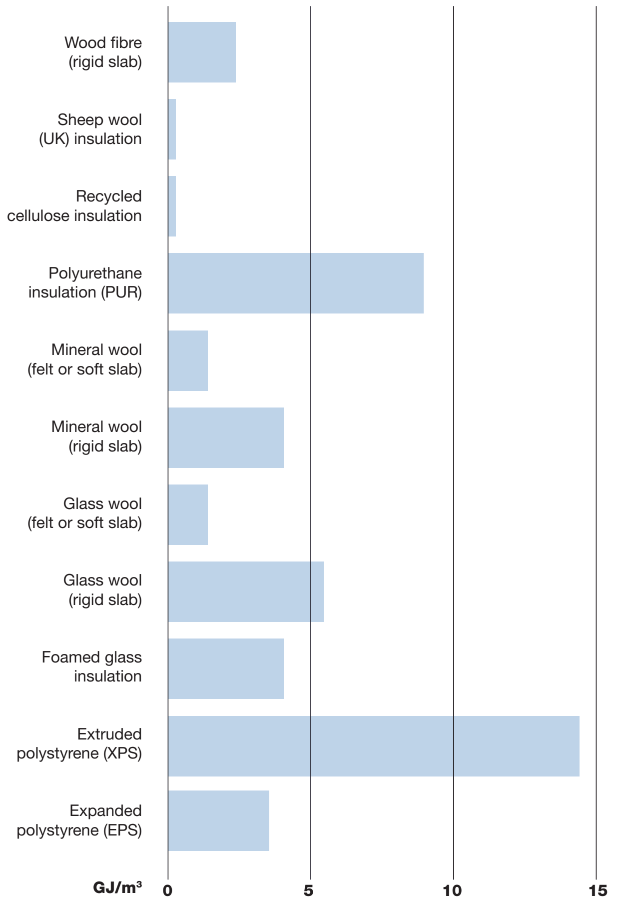
Rainscreen is a relatively high-benefit, low-cost method of providing thermal insulation to external walls for both refurb (overclad) and new projects. It can also help minimise cold-bridging.

Adding insulation to the external surface of the loadbearing structure has three key benefits:

- Increased thermal efficiency – dependent on the fixing system used. Up to 240mm of insulation can be added using a Marley Eternit framing system
- No loss of internal space - insulation added to wall cavities or inner leaf inevitably consumes internal habitable space
- Light weight and easy to fix – insulation can be rapidly and easily fixed to the exterior substrate and adds very little loading to the rainscreen support system

Embodied energy for insulation

The table below shows embodied energy for various insulation products. Lower embodied energy will allow the designer to achieve a higher BREEAM rating.



Data from www.sustainingtowers.org/WALLSa.htm

Cedral Weatherboard, Wansey Street, London Photo © Jonas Lencer

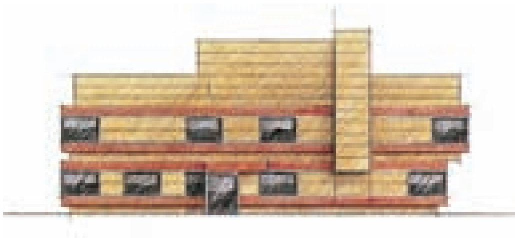
Aesthetics & colour

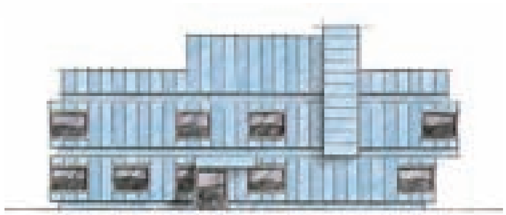
The landscape of colour

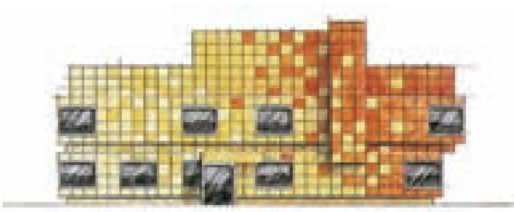
Awareness of - and therefore care for - the environment is increasing steadily. Far more stress is being given to appropriate colouration of both urban and rural environments in all sectors – domestic, industrial, leisure, public and commercial.

Because colours used on buildings are never seen in true isolation, they cannot be considered as absolute and unchanging. They are an integral part of their environment in the most local and most general sense.

As part of the language of building they have an important role to play, as do form and material, in the correct and fluent placing of a structure in its appropriate context.







Colour in context

In some environments, colour has long been used to influence or create mood and atmosphere, to change perception of room shape or size and where appropriate, to express function.

These kinds of influence can be extended to the exterior on the larger scales both of locality and the environment as a whole.

Colour as well as style of architecture is a powerful way of 'contextualising' structures – making them harmonious with or deliberately distinct from both large and small scale environments. This process can be broadly divided into 3 levels (see below).

Alternatively, it may be important to find regional solutions that respect individual locations, by selecting colours to match the tones of the predominant local materials.

Detail

The colour and textures of cladding can be chosen to harmonise or deliberately contrast with the other building materials to which it is adjacent.

Local architecture

In most urban or suburban environments, the general architecture has evolved over a substantial period and therefore has some sort of consistency of scale, material and colour. Choice of cladding type and colour can be important when establishing visual links with these local themes.

Wider context

In an urban or commercial environment, cladding may be used as a dynamic expression of architectural intent.

Panel fixings

The fixing method chosen can have a fundamental and dramatic effect upon the final appearance of the clad building.

Employing a secret fix method, for example, will result in a sheer, smooth facade unobstructed by fixings.

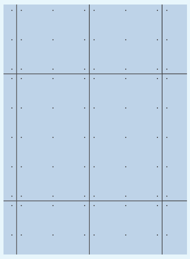
An edge retention system, on the other hand, focuses the eye upon the panel joints and will give the facade a geometric feel, especially when a contrasting colour is chosen for the edge framing members.

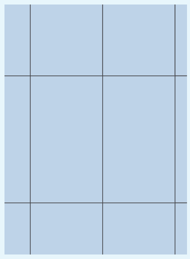
The 'visible fixing' systems – screw and rivet fixing – may be seen as providing an appearance somewhere between secret fix and edge retention. The smooth facade of the cladding will be punctuated by the heads of the rivets or screws, although, in practice, these low profile fixings are virtually unnoticeable.

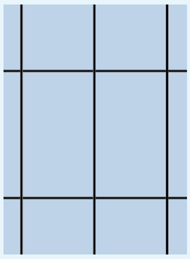
Additionally, fixing methods can be combined to create interesting design detail.

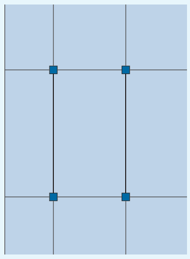
For example, a minimal amount of mechanical fixing can be combined with structural adhesive bonding.

The illustrations, right, show a diagrammatic view of the generic differences in appearance between some typical fixing systems. Please contact our Technical Advisory Service for further information.


Visible fixing screw or rivet


Secret fix


Edge retention

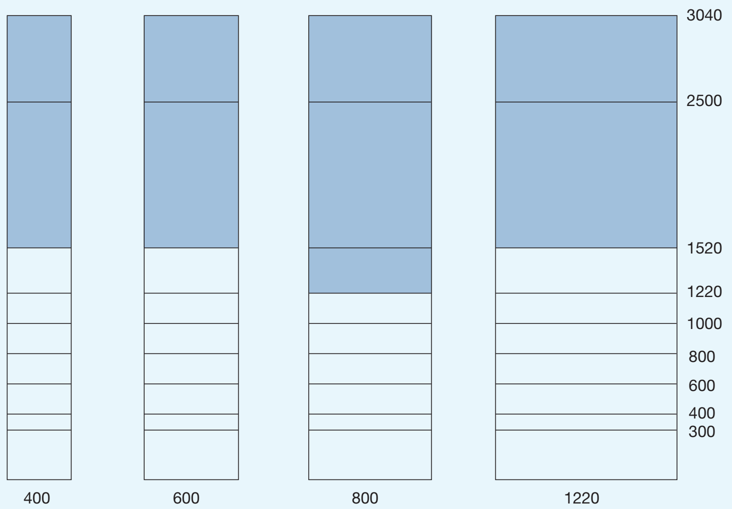

Adhesive fix with square boss at each corner

Economic module sizes

Marley Eternit high performance fibre cement cladding can be made to any module and offer the architect and designer wide design freedom. Economics, however, play a significant part in the selection of claddings and should be considered. When designing, the following information is aimed at providing the specifier with guidance on the most economic material usage from standard sheets.

Sizes greater than half the maximum manufacturing lengths become progressively less economical in ratio to the distance downwards from full length to half length as indicated on the charts. The cost involved in factory cutting of High Performance Claddings to exact sizes is small in relation to the overall installed cost of cladding systems and it may be prudent in some cases to have two small economic panels rather than one large uneconomical panel.

For example an 800mm deep fascia would be more economically clad using 1200mm panel lengths rather than longer panels. The joints in these cases can either be made a feature of or hidden.



The shaded areas indicate the most uneconomic modules cut from a standard sheet.
(Based on 1220 x 3040 sheet).

Recommended design procedure

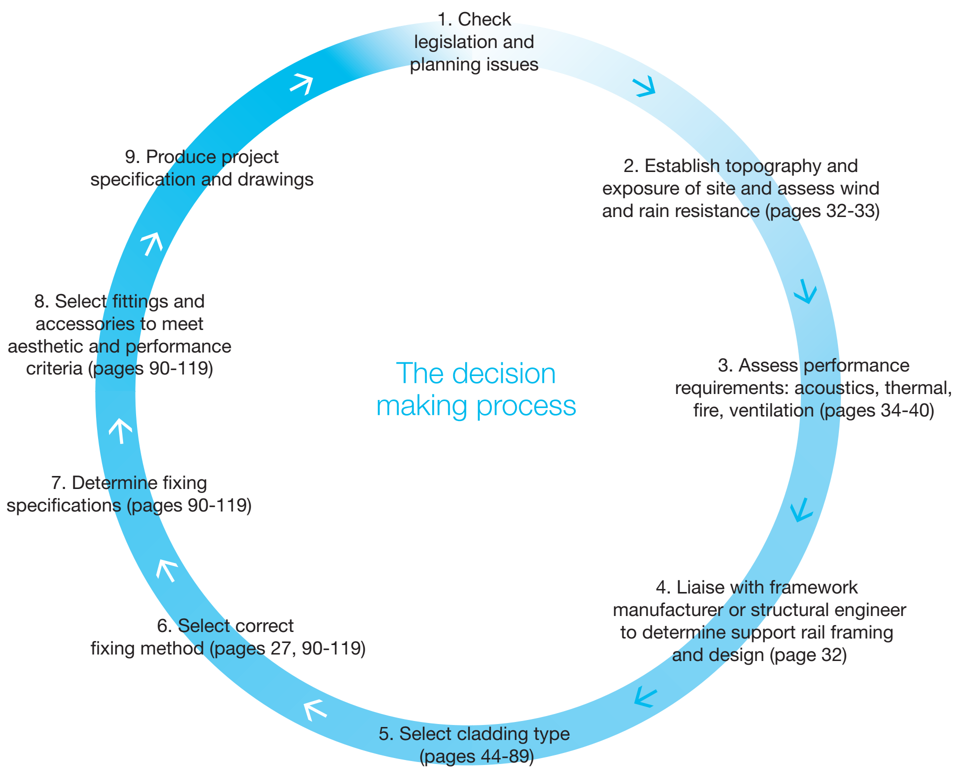
Natura, Brunel University, Uxbridge

Designers are advised to consider the following steps when commencing a design incorporating Marley Eternit products.

Reference should also be made to BS 8200 'Code of Practice for the design of non-loadbearing external vertical enclosures of buildings', also BS 6093 - 'Code of Practice for the design of joints and jointing in building construction', and to BS 8000: Part 6: 'Workmanship on Building Sites: Code of Practice for slating and tiling of roofs and claddings'.

(The following information is provided for guidance only. Designers should ensure that they make all the necessary calculations and take into account all aspects of the specific project design and location.)

Further information can also be found in: CWCT Standard for systemised building envelopes, and NHBC Standards 2008.



Step 1: Legislation and planning

Guidance on legislation is given on pages 30-31. Planning permission may be necessary in certain areas and is dependent on Local Authority policy and control.

Step 2: Exposure, wind and rain

Establish the exposure zone of the site by reference to the map on page 33. This divides the UK into 2 categories of exposure to driving rain and is based on rain penetration data from BS 8104, 'Code of practice for assessing exposure of walls to wind-driven rain' and BRE Report 262 'Thermal insulation: avoiding risks'. The map applies to buildings of up to 12 metres in height at the ridge.

Calculate the wind suction loading in accordance with BS 6399: Part 2, 'Code of practice for wind loads'.

Step 3: Assess performance against regulatory requirements

Cladding performance criteria will vary according to design, building function etc., Further guidance is shown on the following pages: 'Fire', page 34, 'Condensation and ventilation', page 35, 'Acoustics', page 35 and 'Thermal', pages 36-40.

Step 4: Framework and support rail

Determine design of cladding and configuration of support rails with structural engineer and framework manufacturer.

Ensure that the structure is adequate for the total weight of the cladding as installed, and for the calculated wind loading and any other relevant loading criteria (see page 32-33). Weights of panels are shown on the appropriate product pages.

Step 5: Cladding selection

The choice of cladding is a combination of planning, aesthetic and performance criteria. The key factors are shape, size, colour, texture, material and sustainability, see pages 44-89.

Step 6: Fixing Method

Select a fixing method in accordance with the aesthetic and performance criteria.
The panels may use visible screws or rivets, or be secretly fixed. Edge retention systems or a combination of methods can be used to create distinctive design detail, see pages 90-119.

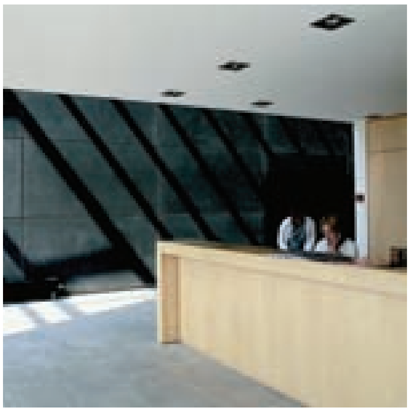
Step 7: Fixing specifications

A full fixing specification should be obtained from the Technical Advisory Service, or by visiting www.marleyeternit.co.uk.

Step 8: Fittings & accessories

Check that any fittings or accessories specified are suitable for the design and its associated performance requirements by referring to the fixing systems page 90-119.

Step 9: Produce project specific specifications and drawings



Natura, used inside European commercial building

Natura, New North Road, Islington

→ More

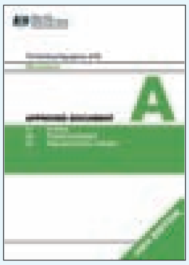
advice E-mail info@marleyeternit.co.uk
Tel 01283 722588

Further information on cladding with respect to colour, shape, size, weights, is on the following pages:

44-49 Natura
50-55 Textura
56-61 Pictura
62-69 Operal
70-81 Cedral Weatherboard
82-85 Bluclad

Legislation, guidance & reference

Before contemplating any cladding project, the designer and contractor must be aware of the current legislation, the design requirements and standards that govern and influence the style, parameters, performance, products and construction of the project. The following section summarises many of the relevant documents, but is by no means exhaustive.

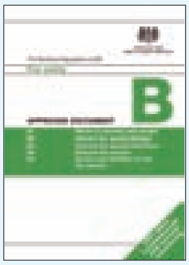


Structure

England and Wales:
Part A 'Structure'

Scotland:
Technical handbook,
Section 1 'Structure'

Northern Ireland:
Part D 'Structure'



Fire

England and Wales:
Part B 'Fire Safety'

Scotland:
Technical handbook,
Section 2 'Fire'

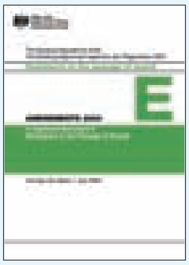
Northern Ireland:
Part E 'Fire Safety'

Moisture

England and Wales:
Part C 'Site Preparation and Resistance to Moisture'

Scotland:
Technical handbook,
Section 3 'Environment'

Northern Ireland:
Part C 'Site Preparation and Resistance to Moisture'



Sound

England and Wales:
Part E 'Resistance to the passage of sound'

Scotland:
Technical handbook,
Section 5 'Noise'

Northern Ireland:
Part G 'Sound insulation of dwellings'

Ventilation

England and Wales:
Part F1 'Means of Ventilation'

Scotland:
Technical handbook,
Section 3 'Environment'

Thermal

England and Wales:
Part L 'Conservation of fuel and power'

Scotland:
Technical handbook,
Section 6 'Energy'

Northern Ireland:
Part F 'Conservation of fuel and power'

Scottish Technical Handbooks

The sections referred to above are contained in the two Scottish technical handbooks, one covering domestic construction, the other non-domestic.

Building Regulations

These are mandatory regulations and, in England and Wales, are generated and approved by the Department for Communities and Local Government (DCLG).

In Scotland they are generated and approved by the Scottish Executive and in Northern Ireland, by The Office Estates and Building Standards Division (OBD).

They must be complied with for all new-build and a great deal of refurbishment work. They consist of the Building Regulations 2000 (as amended) for England and Wales, the Building (Scotland) Regulations 2004, and the Building Regulations (Northern Ireland) 2000.

Compliance with these regulations is the responsibility of the building designer, who may be the owner of the building, his appointed architect, a structural engineer appointed by the owner or his architect or, in the case of small buildings, the actual builder.

The increasing complexity of construction and the codes that govern design has led many building designers to request the specialist services of a cladding or building envelope designer.

The Approved Documents of the Building Regulations (England and Wales), the Technical Handbooks (domestic and non-domestic) (Scotland) and the Technical booklets (Northern Ireland) provide practical guidance for some of the common building situations in respect of the requirements for materials and workmanship.

Copies of the Approved Documents that accompany the Building Regulations 2000 (as amended) for England and Wales can be downloaded from the the Department for Communities and Local Government (DCLG) web site (www.communities.gov.uk) or obtained from RIBA Bookshops, 15 Bonhill Street, London EC2P 2EA. (Tel 020 7256 7222, Fax 020 7374 2737).

Copies of the complete set of Handbooks that accompany the Building (Scotland) Regulations 2004 for Scotland can be downloaded from the SBSA web site (www.sbsa.gov.uk). Follow the links to 'Archive', 'Standards and Guidance' then 'Technical Standards'. They can also be obtained on a CD-Rom from the Scottish Building Standards Agency (SBSA), Denholm House, Almondvale Business Park, Livingston, EH54 6GA (Tel 01506 600400, Fax 01506 600401.

British Standards

A British Standard is a published document that contains a technical specification or other precise criteria designed to be used consistently as a rule, guideline, or definition. They are a summary of best practice and are created by bringing together the experience and expertise of all interested parties – the producers, sellers, buyers, users and regulators of a particular material, product, process or service.

Standards are designed for voluntary use and do not impose any regulations. However, laws and regulations may refer to certain standards and make compliance with them compulsory.

The principal British Standards relevant to this document are:

BS 5534 Gives recommendations for the design, materials, application, installation and performance of slates, tiles, shingles and shakes. It also covers their associated fittings and accessories for use in the construction of pitched roofs and vertical cladding applications. (BS 5534 should be read in conjunction with BS 8000-6)

BS 5588 Fire precaution in the design, construction and use of buildings.

BS 6093: 2006 Design of joints and jointing in building construction.

BS 8200: 1985 Code of Practice for design of non-loadbearing external vertical enclosures of buildings.

BS 476-6: 1989 Fire tests on building materials and structures – Method of Test for fire propagation for products.

BS476-7: 1997 Fire tests on building materials and structures – Method of test to determine the classification of the surface spread of flame of products.

BS EN 12467: 2004 fibre cement flat sheets, product specification and test methods. Provides information on the technical requirements.

BS EN 13501-1: 2002 fire classification of construction products and building elements – Classification using test data from reaction to fire tests.

BS 8000-6: 'Workmanship on building sites. Code of practice for slating and tiling of roofs and claddings'. Applies to the laying and fixing of claddings and their associated fixings and accessories. Common Arrangement of Work Section (CAWS) classifications H60, H61 and H65.

BS 5250: 'Control of Condensation in Buildings' Describes the causes and effects of surface and interstitial condensation in buildings and gives recommendations for their control.

Health and safety

To ensure safe working practices during construction, the designer should consider relevant safety regulations. These include the Construction (Design and Management) Regulations and the Health and Safety Executive's approved code of practice for management of health and safety at work.

Certain advisory bodies such as the National House Building Council (NHBC), Loss Prevention Council (LPC), Building Research Establishment Ltd (BRE) and Timber Research and Development Association (TRADA) also produce recommendations and guidance on construction which should be considered.

→ More
pages 120-123 'Sitework'
134 'References'

Wind resistance

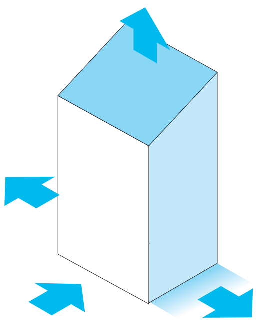
Wind forces on buildings

Each year as many as 200,000 buildings in the UK may be damaged by gales. Roof damage represents by far the largest sector of the total number of building elements affected.

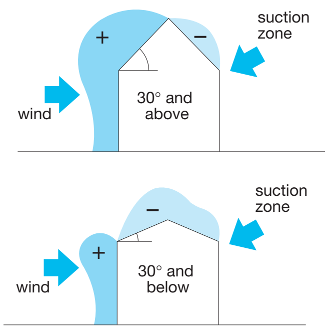
Wind can affect a building in a pattern determined not only by climate and topography, but also by wind direction, the shape of the building and the pitch of the roof.

Wind blowing at 90° to a building is slowed down when it hits the surface of the building, with a consequent build-up of pressure. At the same time, it is deflected around the end walls and over the roof, creating areas of negative pressure or suction. The stronger the wind, the greater the suction.

The force of the wind acting on the windward face of a building creates a positive pressure, although, even here, there are areas where suction develops. Leeward faces are always subject to suction.



Directions of pressures generated by wind force



Pressure distribution in relation to roof pitch

Design for wind loading

The standard method in BS 6399-2 'Loading for buildings – Code of practice for wind loads' should be used to determine the basic wind speed of the site, which is then used to calculate the effective wind speed and dynamic wind pressure on the envelope, by applying a series of factors to account for terrain, topography, building height and length etc.

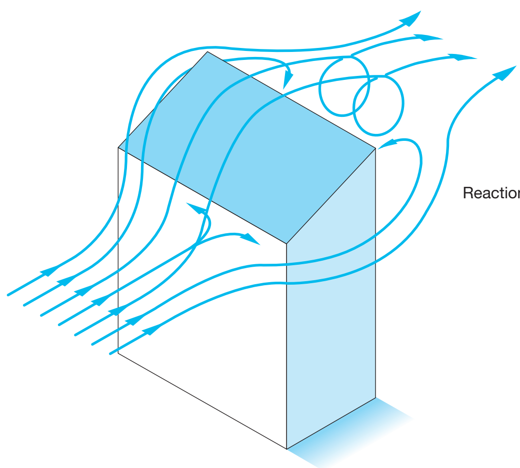
Wind loading

Calculate the dynamic pressures of the wind (including the appropriate pressure coefficients for the building) in accordance with BS 6399-2 wind loading or EN 1991-1-4.

The spacing of the profiles and brackets is determined by calculation once the wind forces on the structure have been determined. The Ventisol system has been wind tested by the Building Research Establishment (BRE) and is classified as permeable when applied to nominally impermeable walls. In this situation, a large proportion of the external wind pressure is able to leak through the cladding to act directly on the building wall, relieving the loads on the cladding. The provisions of all current codes of practice, including that for the UK are intended to give design loadings for typical impermeable buildings and do not provide data in the required form to enable the loading on permeable overcladdings to be assessed.

The response of the Ventisol overcladding system to wind loading has been determined by direct measurements. A system performance specification has been defined with which the actual performance is shown to comply.

Using this system performance, a computer based numerical model of the behaviour of the system when installed on a building has been developed and run for a number of typical installations. It is concluded that the maximum nett suction on the standard system without fire-stops can be taken as one-half of the design external wind pressure.



Reaction of wind flow to obstruction

→ More

advice E-mail info@marleyeternit.co.uk
Tel 01283 722588

web marleyeternit.co.uk/cladding

Choice and type of anchor

Consideration must be given to:

a) the strength and state of the existing structure.

b) the capability of the chosen anchor to accept the live and dead loads imposed, and an adequate safety factor.

Aircraft vortices

Cladding near airports can experience high local wind load forces due to air vortices created by certain aircraft when taking off and landing, which may be greater than the calculated wind loads to BS 5534. Designers should seek advice from the Airport Authority Planning Department when designing in these locations.

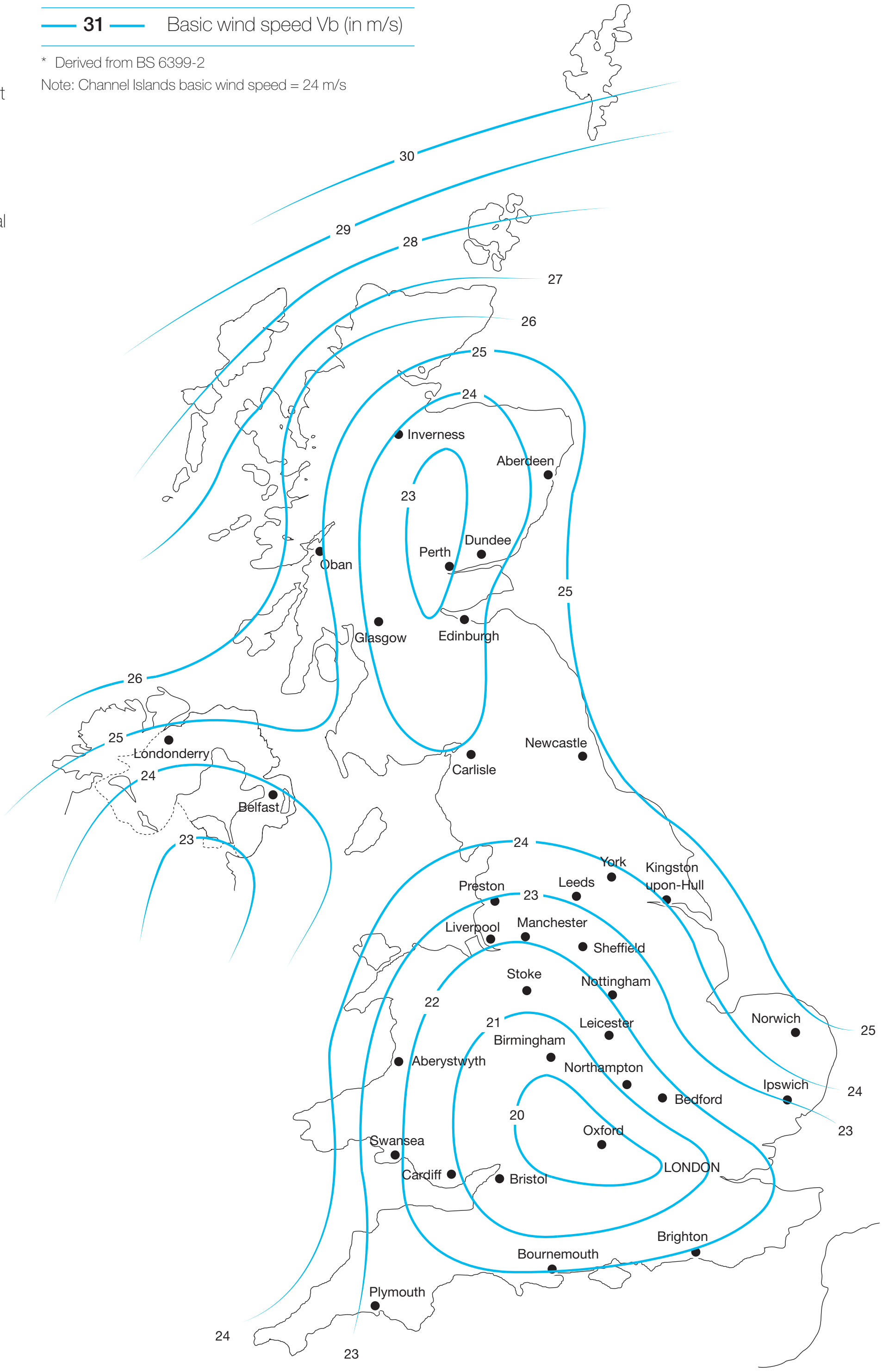
Basic wind speed*

Basic wind speeds

—— **31** —— Basic wind speed Vb (in m/s)

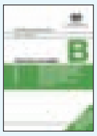
* Derived from BS 6399-2

Note: Channel Islands basic wind speed = 24 m/s



Fire safety, acoustics, condensation & ventilation

Fire safety



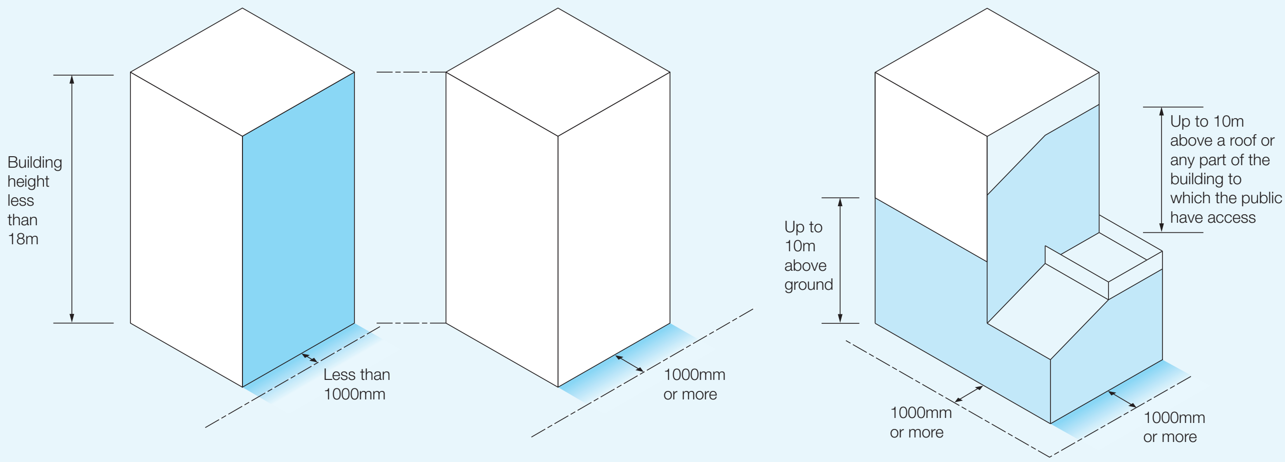
Building Regulations

The relevant document is Approved Document B, 'Fire Safety.'

Key to external wall surface classification

—·—·—	Relevant boundary
(white)	No provision in respect of the boundaries indicated
(blue)	Class 0 (National Class) or class B-s3, d2 or better (European class)
(light blue)	Index (I) not more than 20 (National class) or class C-s3 d2 or better (European class). Timber cladding at least 9mm thick is also acceptable. (The index I relates to tests specified in BS 476: Part 6).

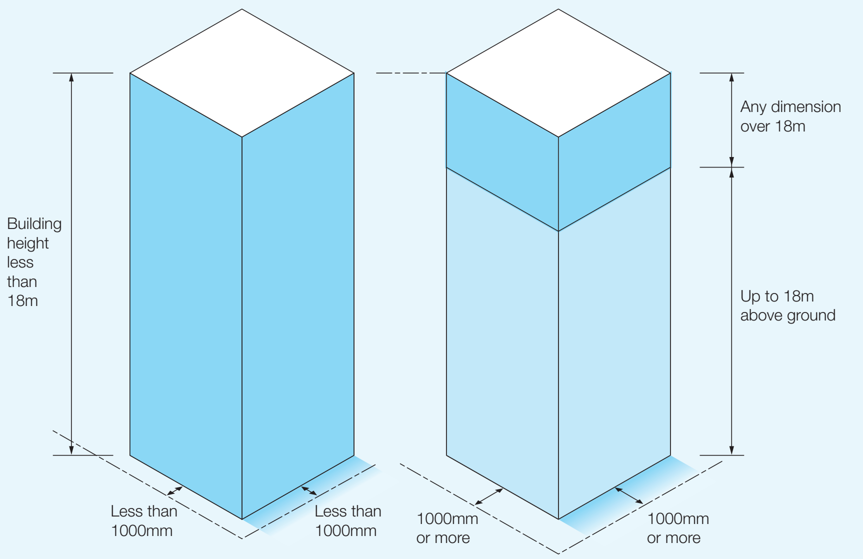
B4 – Provisions for external surfaces of walls



A. Any building

B. Any building other than C.

C. Assembly or recreation building of more than one storey



D. Any building

E. Any building

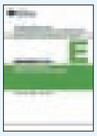
Notes:
The National classifications do not automatically equate with the equivalent European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly.

When a classification includes 's3, d2', this means that there is no limit set for smoke production and/or flaming droplets/particles.

Scottish Regulations

'A2' classified materials are classified as non-combustible. Marley Eternit fibre cement cladding products are all A2-s1-d0.

Acoustics



Building Regulations

The relevant document governing acoustic design, especially for dwellings, is Building Regulations Approved Document E 'Resistance to the passage of sound' within which, the relevant sections are:

E1: Protection of sound from other parts of the building and adjoining buildings.

E2: Protection against sound within a dwelling house.

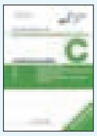
Other documentation, such as (HTM) Health and Technical Memoranda 56 and 2045 for hospitals and Building Bulletin (BB) 87 and 93 for schools, offers guidance on meeting Building Regulations for specific building types. BS 5821 detailing the 'methods for rating the sound insulation in buildings and of building elements', is also relevant.

Resistance to the passage of sound

Approved Document E deals with the resistance of both airborne and impact sound generated within buildings, and requires that dwellings, flats and rooms for residential purposes shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings. Separate requirements apply to schools, where each room or space in the building shall be designed so that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use.

Further information can be obtained by reference to BS 8233 'Sound insulation and noise reduction in buildings' and BS EN ISO 717-1 'Acoustics – Rating of sound insulation in buildings and of building elements. Part 1 Airborne sound insulation', and BS EN ISO 717-2 'Acoustics – Rating of sound insulation in buildings and of building elements. Part 1 'Impact sound insulation'.

Condensation and ventilation



Building Regulations

Approved Document C 'Site preparation and resistance to moisture' contains information relating to the control of and resistance to condensation in buildings.

Approved Document Part F1 'Means of ventilation'.

Contains information on the provision of natural and mechanical ventilation for buildings. This is with specific reference to the reduction and removal of condensation.

Control of condensation

Condensation has become more of a problem with the increase in highly insulated buildings. Moreover, changes in lifestyle have led to higher levels of water vapour in modern buildings. This water vapour naturally ascends to the roof space, where it condenses on contact with cooler surfaces. Further condensation is likely to be caused by climatic conditions, and may eventually result in timber rot, metal corrosion and damage to insulation and fittings.

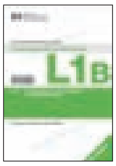
Detailed information on methods to control harmful condensation is given in British Standard BS 5250: 'Code of practice for control of condensation in buildings' Section 8.4 'Roofs'. Prevention of condensation in roof voids is best achieved by the provision of natural air ventilation.

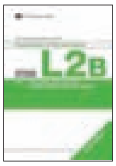
BS 5250 states that the designer should take account of the following moisture sources in buildings:

- water incorporated during the construction process (including precipitation);
- precipitation after construction;
- water vapour arising from the occupants and their activities;
- temporary condensation occurring when cold weather conditions are followed by warm, humid weather.

Thermal insulation

Building Regulations





The relevant documents are Approved Document L1A 'Conservation of fuel and power in new dwellings'; L1B 'Conservation of fuel and power in existing dwellings' ; L2A 'Conservation of fuel and power in new buildings other than dwellings' and L2B 'Conservation of fuel and power in existing buildings other than dwellings' for England and Wales and Section 6 'Energy' (domestic and non-domestic) for Scotland (see separate leaflet).

The Building Regulations prescribe high standards of building fabric insulation for floors, walls and roofs as well as space heating, lighting, and hot water controls so as to limit the heat loss from the building .

The government have improved the regulations in terms of energy efficiency to create a 40% improvement in reduction of carbon emissions since 2002.

The Part L Approved Document took effect as of 1st October 2010, The Secretary of State issued the document to provide practical guidance on ways of complying with the energy efficiency requirements and regulation of the Building Regulations 2000 for England and Wales, as amended.

Compliance

The new requirements of the Regulations are designed to reduce carbon emissions from new buildings and to improve the performance of existing buildings where new work is carried out.

Parts L1A, L1B, L2A and L2B have a single method of compliance. This is expressed in CO_2 emissions in kg/m²/year and is calculated by the SAP (Standard Assessment Procedure) 2009 method for dwellings and the iSBEM model for non-dwellings or all buildings over 450m². This involves a series of calculations based on heat loss of elemental areas, volumes of spaces to be heated, heating systems, solar gain etc., for which computer software models are available.

In terms of the external walls and claddings, designers will no longer be able to specify "walls to comply with Part L" on drawings or in specifications. Products can no longer be labelled 'Part L compliant', as not one element or product can meet Part L without consideration for all other elements in the construction and energy use of the building.

The design process is now more complicated as a number of assumptions have to be made at the design stage when inputting into the SAP or iSBEM calculations before the specification can be finalised, to see if the building will be compliant with Part L compared to a notional building.

The main variables to consider are:-

- External envelope U-values for walls, roofs and floors
- Thermal bridging details
- Ventilation strategy for ensuring fresh air
- Airtightness

The following sections briefly summarise the content of the four parts of Part L –

Part L1A - 'New dwellings'

The target CO_2 Emission Rate for dwellings up to 450m² is calculated using SAP (Standard Assessment Procedure) 2005 for a 'notional' dwelling of the same size and shape as the 'actual' dwelling (based on set construction rules).

The Simplified Building Energy Model (SBEM) will be used for larger dwellings.

The Dwelling Emissions Rate (DER) must be no higher than the target. Two phases of calculation for the DER are required:

1 Design calculations presented in a report to Building Control that defines the critical design features

2 Following dwelling pressure testing, a final calculation to confirm that the building complies 'as built'

Part L1B – 'Existing dwellings'

This includes most extensions, material changes of use, material alterations, provision of controlled fittings and services and provision or renovation of a thermal element. The recommended maximum U-values for an extension may be varied on condition that it is no worse overall than a similar extension built to the standards and that the defined maximum U-values are not exceeded.

SAP 2009 can be used to demonstrate that CO_2 emissions from a dwelling plus an extension taken together are no worse than that of the dwelling complying with regulations plus a separate extension complying with regulations. This process may involve improvements to the existing thermal elements, such as walls, roofs and floors, which must comply with Part L1B standards.

Limiting U-value standards (W/m² K) (Part L1A New Dwellings)

Element	Area-weighted average
Eternal wall	0.30
Party wall	0.20
Roof	0.20
Floor	0.25
Windows	2.00

* Excluding display windows and similar glazing. There is no limit on design flexibility for these exclusions but their impact on CO_2 emissions must be taken into account in calculations.

† The U-values for roof windows and rooflights in this table are based on the U-value having been assessed with the roof window or rooflight in the vertical position. If a particular unit has been assessed in a plane other than vertical, the standards given in the Approved Document should be modified by making an adjustment that is dependent on the slope of the unit following the guidance given in BR 443 'Conventions for U value calculations'. BRE.2006.

Part L2A - 'New non-dwellings'
There are 5 key criteria for compliance:

1 CO_2 emissions must be less than target value
2 The thermal performance of building fabric and services must satisfy minimum standards
3 Summer time solar gains must be controlled
4 Pressure testing and 'Quality of Construction' will be mandatory
5 Building users should be supplied with sufficient information to operate the building in the most energy efficient manner.

Significant improvements in carbon dioxide emissions are required when comparing the notional and actual results. In general terms these represent the improvements to the levels stated in the 2006 regulations:

Heated and naturally ventilated: 23.5%
Heated and mechanically ventilated: 28%
Air conditioned: 28%

Again, two phases of calculation for emissions rate are required:

1 Design calculations presented in a report to Building Control
2 Following full building pressure testing, a final calculation to confirm that the building complies 'as built'.

Part L2B – 'Existing non-dwellings'
This applies to extensions and subsequent fit out works, change of use, material changes, work on controlled services etc. New building fit outs for existing buildings should comply with new building regulations.

Part L 2006 introduces 'Consequential Improvements' which may in some situations require the upgrading of windows, boilers, air-conditioning and lighting as well as the inclusion of energy metering systems.

For all parts
Where possible, LZC (Low and Zero Carbon) systems should be installed.

Unit energy costs for each fuel type are detailed in the Approved Document and should be used for assessing the feasibility of various improvements.

Airtightness/air leakage

Part L 2010 provides requirements for buildings to be tested for air leakage once completed. Testing is carried out using pressurised fans and consultants, to ensure that as well as the theoretical heat loss calculations, the building is not leaky and wasting energy through gaps and cracks due to construction methods.

Workmanship and detailing on site to ensure that a permitted air leakage of $10m^3/hour/m^2$ @ 50 Pa is not exceeded when tested.

The building designer has to make an assumption of what the level of airtightness he can achieve from his building at the design stage. This is inputted into the calculation for his heat loss/SAP calculations. Should the building be found to be higher in terms of air leakage, then remedial measures must be taken to ensure the building meets the required design value.

Design considerations

There are a number of factors to consider when designing buildings that are to meet the new Part L requirements. These will involve the types of windows, doors, rooflights, solar gain, frame factor, air infiltration, U-Values, type of glass, total area and aspect of the dwelling. The designer will also be required to consider the heating system, the impact of any mechanical ventilation systems, along with the controls, and any low and zero carbon technologies, e.g. solar PV, wind power. Credits will be achieved for the use of 'low carbon' and energy saving products, which in many cases will be the preferred route to compliance. This will involve an assessment of the whole building performance and not just each individual value.

In order to improve the quality of design details, a set of 'Accredited Construction Details' have been published to accompany the new Part L. These are updated versions of 2002 Thermal 'Robust Details', and if approved over specifications could limit the requirement for on-site testing.

Attention is given to the provision of suitable insulation to prevent heat loss and cold bridges in roof construction. Guidance measures to prevent moisture ingress, condensation and air leakage are incorporated into the construction details for walls, floors and roofs, with particular attention being given to the junctions of walls to floors and walls to roofs.

As insulation levels increase so does the potential risk of condensation, and so designers should consider the recommendations with regard to the prevention of condensation in 'cold' roof voids contained in BS 5250: 2002 AMD 1, which is also referenced in Approved Document C of the Building Regulations.

Thermal design details

new structures – housing

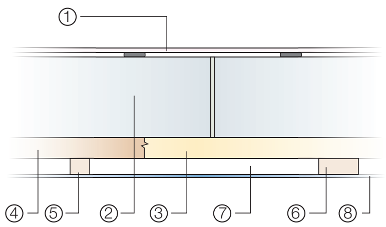
Blockwork wall

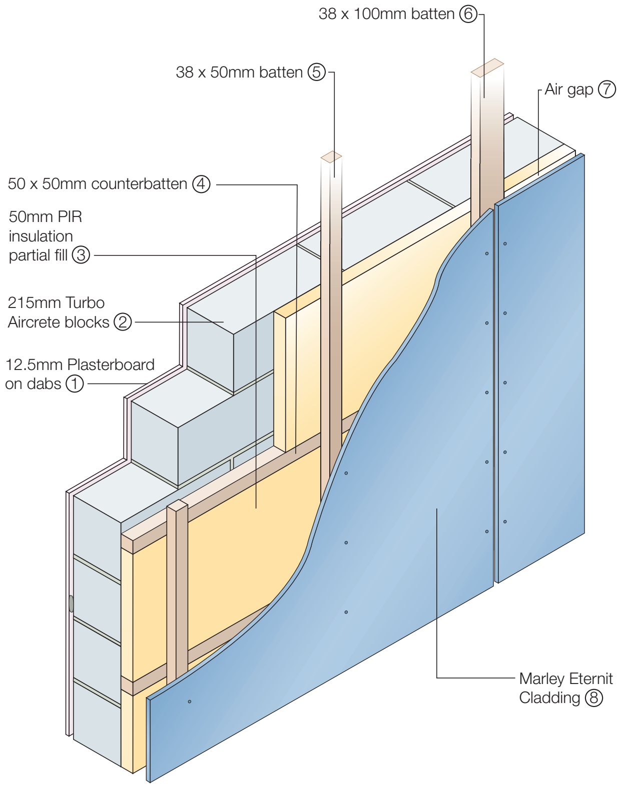
0.25
u-value

- Marley Eternit external cladding
- 38 x 50mm and 38 x 100mm timber battens
- Counterbattens 50 x 50mm
- Single skin 440 x 215mm Aircrete blocks
- 50mm PIR insulation

Notes

- Internal wall should be 12.5mm plasterboard on dabs

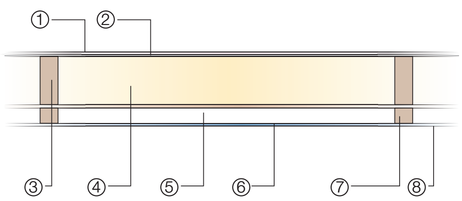


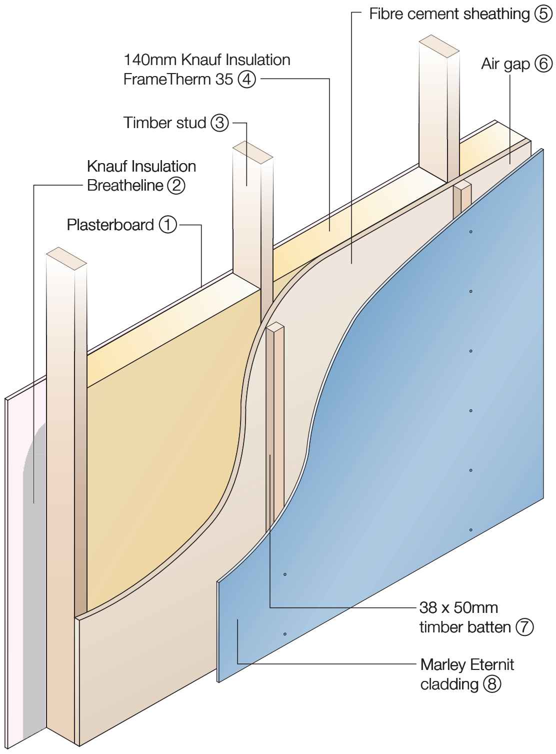


Timber frame wall

0.29
u-value

- Marley Eternit external cladding
- 38 x 50mm timber battens
- 140 x 60mm timber studs
- 140mm Knauf FrameTherm 35 insulation between studs
- Knauf Insulation Breatheline vapour control layer between plasterboard and timber studs





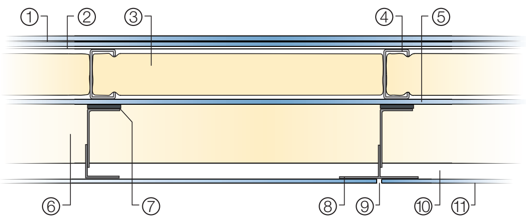
Thermal design details

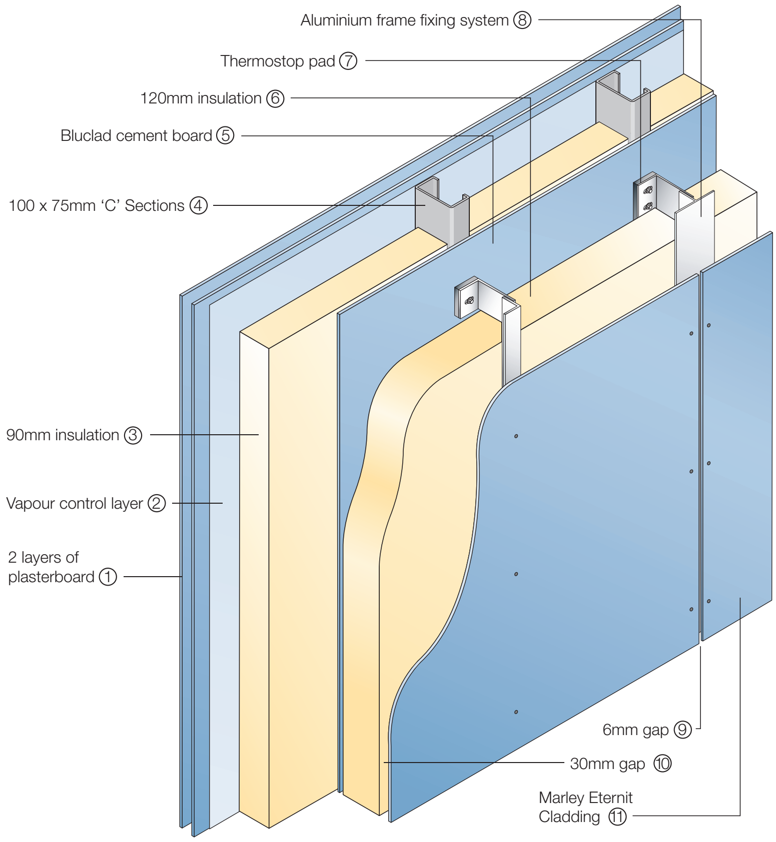
new structures – commercial, education or healthcare

Lightweight steel frame

0.23
u-value

- Marley Eternit external cladding
- 125mm stone mineral wool
- Ventisol or similar framing system
- Bluclad cement board
- 100 x 75mm 'C' sections
- 90mm glass mineral wool
- Vapour control layer
- Internal wall should be 2 layers of 12.5mm plasterboard on dabs





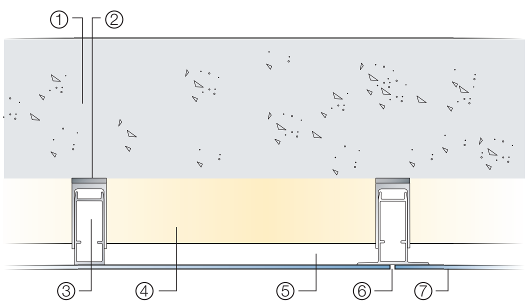
Concrete wall construction

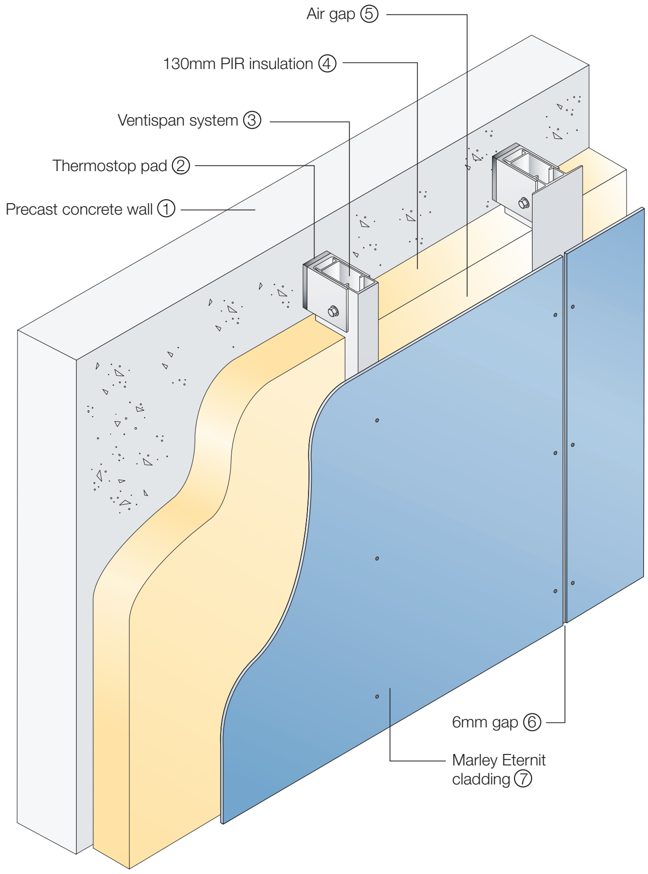
0.14
u-value

- Marley Eternit external cladding
- Ventispan framing system
- 130mm PIR insulation
- Structural concrete slab
- Steel framing infill system (between floors)

Notes

- A very wide variety of internal wall finishing options are available, many of which will incorporate further layers of insulation.





Thermal design details

upgrading existing structures and overcladding

Brickwork wall

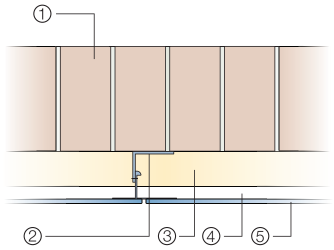
0.35 u-value

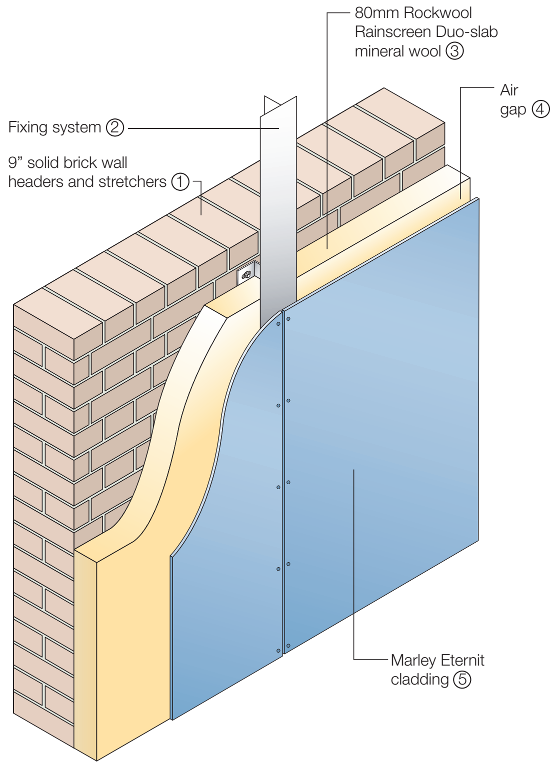
upgrade

2.00 u-value

- Marley Eternit external cladding
- Ventisol fixing system
- Air gap
- 80mm Rockwool Rainscreen Duo-slab mineral wool
- 9" solid brick wall (laid as headers and stretchers)

Notes:
- 9" solid walls are common in pre-1930 house construction and the brick bonding can be in a number of configurations
- U-values of these types of wall are typically 1.9-2.2 W/m²K
- Other fixing systems can also be used
- Greater (or lesser) depths of insulant can be accommodated





Block and brickwork wall

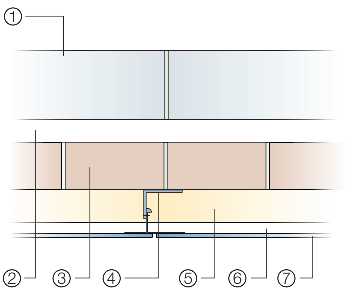
0.33 u-value

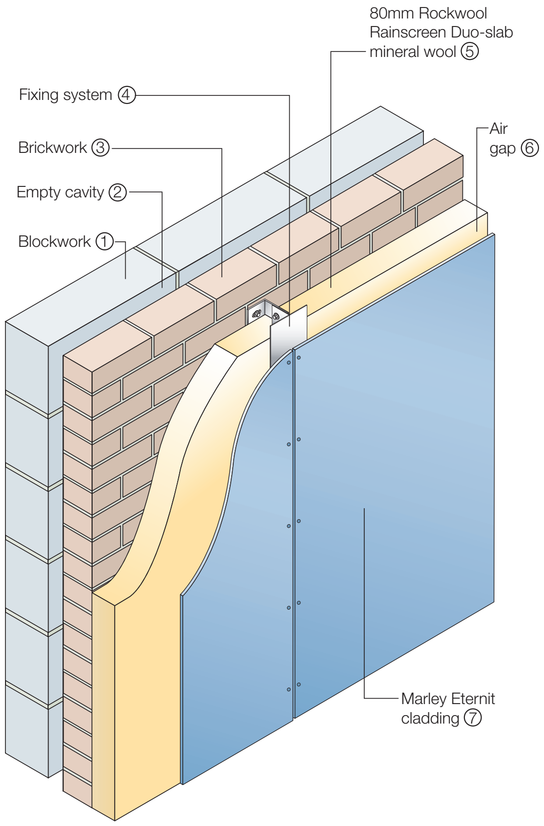
upgrade

1.50 u-value

- Marley Eternit external cladding
- Ventisol fixing system
- Air gap
- 80mm Rockwool Rainscreen Duo-slab mineral wool
- Brick outer skin
- Cavity not insulated
- Brick inner skin

Notes:
- U-values of these types of un-insulated wall are typically 1.0-1.6 W/m²k
- Other fixing systems can also be used
- Greater (or lesser) depths of insulant can be accommodated





Natura, Barking Foyer, Barking