KNAUF INSULATION

it's time to save energy

April 2012

Section 3.3

Built-up Metal Walls

energy saving | warmth | quietness | fire protection | sustainability

Built-up metal walls

Built-up metal wall design

Thermal insulation

Built-up metal walls can be installed on all types of residential and non-residential buildings, although they are most commonly installed on non-residenial buildings such as offices, shops and warehouses. It is possible to achieve very high standards of thermal insulation using built-up metal walls, but due to the complex nature of heat flow through these systems (due to the way they are assembled) it is not possible to calculate U-values using the normal simplified methods.

Knauf Insulation Technical Advice and Support Centre can calculate the specification of insulation needed to achieve specific U-values (including the effect of thermal bridging for simple rail and bracket systems) but normally one would consult the system manufacturer, which is also the case for standing seam systems.

Air permeability

The uncontrolled infiltration or air leakage from a building has a significant impact on its energy efficiency. With good detailing and workmanship during the construction phase it is possible to achieve very high standards of airtightness in built-up metal wall constructions. This will of course restrict uncontrolled infiltration or air leakage and improve the energy efficiency of the building. Part L of the Building Regulations requires a measurement of the air permeability to be included in the whole building calculations used for compliance. The Simplified Building Energy Model (SBEM) is used for non-residential buildings and the Standard Assessment Procedure (SAP) is used for residential buildings. Typical problem areas include the junction of building elements at window and door openings or penetrations through the system such as rooflights.

Thermal bridging

There are two categories of thermal bridging that occur in built-up metal walls, the repeating thermal bridges inherent in built-up space type systems and the non repeating thermal bridges that occur at junctions and openings in the construction. The effect of the repeating thermal bridges are taken account of and included in the U-value calculation for the wall.

Non repeating thermal bridges such as those found at junctions and openings must be calculated separately and the associated heat losses included in the SBEM or SAP calculations. Heat loss through linear thermal bridges (known as the psi value) is accounted for by multiplying the length of each thermal bridge by its psi value.

Acoustic performance

Buildings with built-up metal walls may need to incorporate noise control measures not only to meet Building Regulation requirements, but also Health and Safety and Environmental Health Regulations as well as the building occupiers specific requirements. These measures can be grouped into two categories, sound insulation and sound absorption.

Sound Insulation

A poorly designed built-up metal wall can transmit a significant amount of sound, which will lead to the building failing to provide an acceptable level of protection either to the users or occupants of the building or to people living close to the building from noise generated within the construction envelope.

One of the most effective methods of improving sound insulation is to increase the mass of the structure. Built-up metal walls are generally lightweight, however they are able to provide a high level of separation (between the internal and external metal sheets) and also include glass or rock mineral wool within the structure which provides very high levels of sound absorption. When the effects of separation and sound absorption are combined in a built-up metal wall it is possible to achieve outstanding levels of sound insulation.

Health and Education requirements

Building Regulations primarily impose a requirement on external walls in schools where it is a requirement that the building should meet the standards set out in Section 1 of Building Bulletin 93 'The Acoustic Design of Schools'. This sets specific upper limits for indoor ambient noise levels. Factors affecting the performance required by the walls will include noise from road, rail, air traffic and industrial and commercial premises.

The acoustic performance required in other types of buildings may be controlled by government requirements such as hospitals under HTM 08-01

(previously HTM 2045), or specific client requirements. Environmental Health Regulations may require specific sound insulation performance from external walls where high levels of internal noise are generated, such as industrial buildings and sports and concert halls to stop sound breaking out of the building and thus prevent noise nuisance to neighbours.

Sound absorption

The control of the indoor acoustic environment is important to maintain health and safety for workers and occupants of buildings. It is possible using perforated metal liner sheets containing a sound absorbing lining (usually glass or rock mineral wool) to control sound reverberation which would otherwise be problematic.

Rain noise

Acoustic performance has traditionally not featured high on the list of design priorities but guidance now states that it is essential that rain noise is considered in the design of built-up metal systems as it can significantly increase the indoor ambient noise level. Future intention is that rain noise will be considered within Building Bulletin 93. Until this time, it is appropriate for design teams to provide evidence to the building control body that the built-up metal system has been designed to minimise rain noise where required.

Fire protection

It is a requirement of the Building Regulations that external cladding elements shall resist the spread of fire from one building to another.

The degree of fire resistance which the external roofing element must provide will depend upon the size and use of the building and it's distance from any boundary. Further performance information will be available from the cladding system manufacturer, whose built-up metal wall systems have the advantage of using non-combustible glass and rock mineral wool insulation.

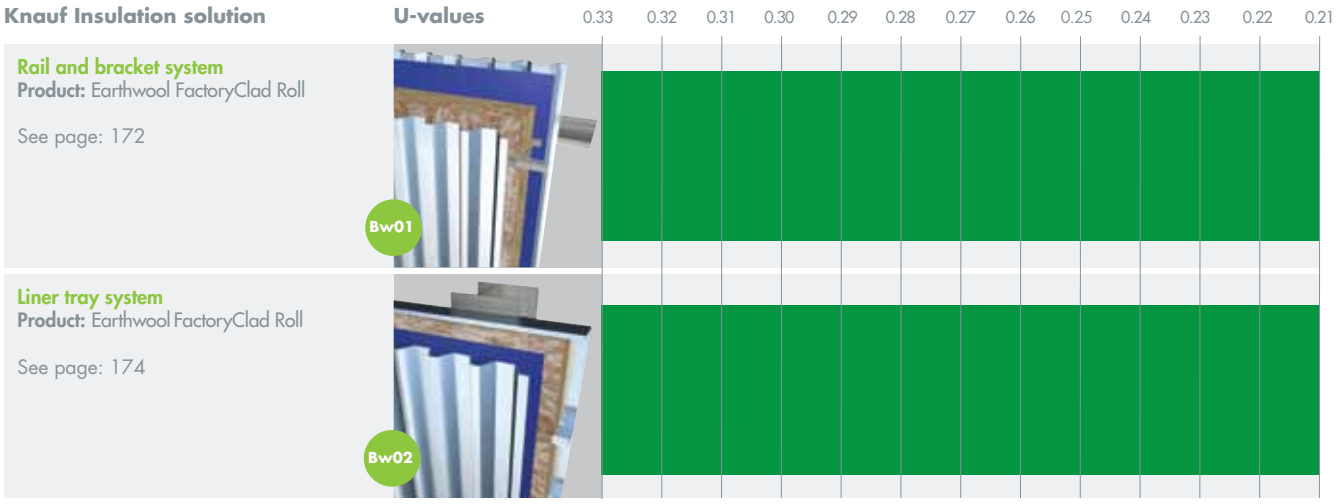
Control of condensation

Surface condensation could potentially occur on the underside of the liner sheet if there were significant thermal bridges through the system, interstitial condensation could occur within the structure of the system if there was a significant break in the vapour control layer. Many proprietary systems have sealed joints and overlaps in the liner sheet in order to provide the vapour control layer or they contain a separate vapour control layer in the form of a polyethylene sheet which itself has sealed joints and overlaps. Where a perforated liner sheet is used then a separate vapour control layer should always be installed.

The spacer system used to support the outer cladding sheet contains a potential thermal bridge and thus could be a point for localised condensation on the liner sheet. However, modern built up metal systems include a significant thermal break pad underneath the support brackets as a necessity for the achievement of the specified U-value, and as such the chance of condensation occurring where the spacer system is fixed to the liner sheet is negligible. If there are significant gaps in the insulation layer then it may be possible for localised surface condensation to occur.

The likelihood of either problem occurring is extremely low, however, extra care needs to be taken in buildings with high levels of humidity such as swimming pools or food processing plants.

Solution optimiser and pathfinder



Key

Thermal insulation achievable by constructions within this document.

Pb01 Find online. Visit knaufinsulation.co.uk and key in construction code to find the most up to date information on your chosen solution.

Built-up metal walls

Rail and bracket system

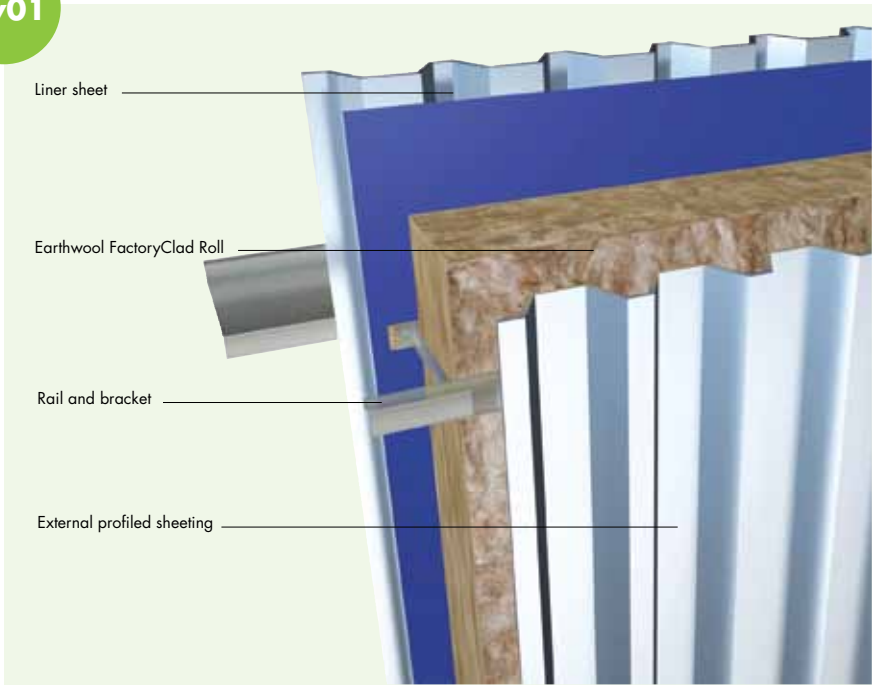
Earthwool FactoryClad Roll

Bw01

- Interlocking nature of mineral wool ensures:
  Rolls knit together at joints ensuring no loss of thermal or acoustic performance
- Joints between rolls are closed, preventing air movement and infiltration through or around the insulation
- Lightweight cost effective solution

Earthwool FactoryClad Roll

- Non-combustible with a Euroclass A1 reaction to fire rating
- A+ Generic BRE Green Guide rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool FactoryClad Roll is a range of flexible, lightweight, non-combustible, resilient glass mineral wool quilts. They are manufactured in long lengths and have exceptionally high tear strength, making them particularly suitable for use in the walls of profiled metal clad buildings.

Typical construction

Profiled metal external sheet, rail and bracket spacer system with thermal break, profiled metal liner and Earthwool FactoryClad Roll installed between the external metal profiled sheet and the inner liner sheet.

Earthwool FactoryClad Roll is used for the thermal and acoustic insulation in profiled metal clad roofing systems. With a Euroclass A1 fire classification, its use can potentially reduce insurance premiums when compared to foam composite panels. Earthwool FactoryClad Roll is manufactured 1200mm wide and in long lengths, making it particularly suitable for use in profiled sheeting systems.

Installation

Following the erection of the building frame and sheeting rails, the internal profiled metal liner is fixed, together with the metal spacer system. Seals are applied as necessary to minimise air leakage.

Earthwool FactoryClad Roll is installed against the liner panels and between the spacers, with all quilt edges tightly butted. With rail and bracket spacer systems, the rail holds the insulation tightly to the internal sheets. Profiled metal external sheets are fixed as soon as possible after the Earthwool FactoryClad Roll, to avoid exposure to the weather.

Performance

Thermal performance

Earthwool FactoryClad Roll 32 has a thermal conductivity of 0.032 W/mK

Earthwool FactoryClad Roll 37 has a thermal conductivity of 0.037 W/mK

Earthwool FactoryClad Roll 40 has a thermal conductivity of 0.040 W/mK

Knauf Insulation recommend that the system designer is contacted for specific U-value calculations.

Fire

Earthwool FactoryClad Roll is classified as Euroclass A1 to BS EN ISO 13501-1

Vapour resistivity

Earthwool FactoryClad Roll has a vapour resistivity of 7.00 MN.s.g.m.

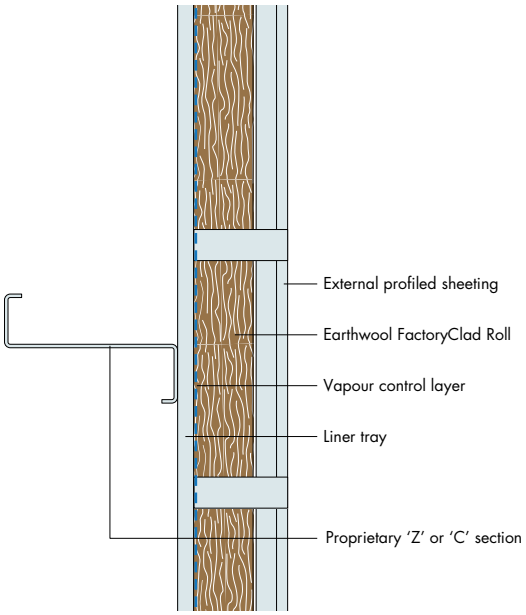
Acoustic performance

Sound absorption: Achieved by perforating the metal liner sheet and incorporating a 'soft' absorbing insulation material behind it. Different combinations of perforations and levels of insulation will give varying results of sound absorption.

Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The acoustic performance can be increased by varying the number and the density of the insulation layers as well as adding additional mass into the construction.

Rain impact noise and flanking sound: System manufacturers have achieved significant impact noise reductions through the use of mineral wool insulation.

Typical sections



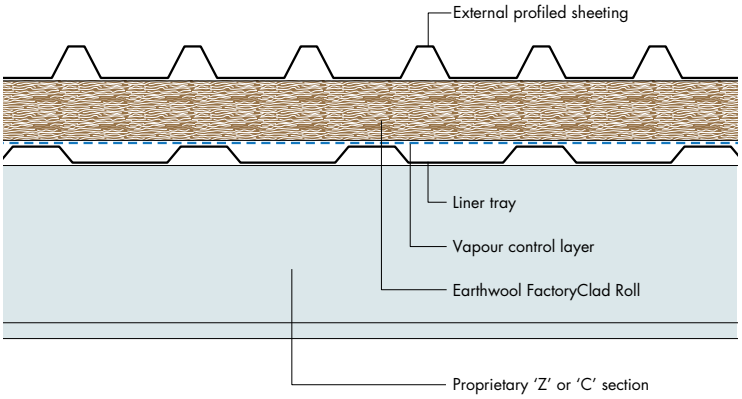


Table 20 - Typical U-values for a rail and bracket system

Product	Rails at 1.20 metre spacings	
	Thickness (mm)	U-value (W/m²K)
Earthwool FactoryClad Roll 32	170	0.21
	160	0.22
Earthwool FactoryClad Roll 37	180	0.23
	160	0.26
	140	0.29
Earthwool FactoryClad Roll 40	160	0.27
	140	0.31
	130	0.33

BBA CERTIFICATE CS/1001-2 U Value Competency Scheme

Notes: Generic rail and bracket U-value calculations can be provided by our Technical Advice and Support Centre, however, for proprietary rail and bracket systems and all standing seam systems, the system manufacturer should be consulted for project specific U-value calculations.

Typical specification

Earthwool FactoryClad Roll 32*/37*/40* ……mm thick, to be positioned over the inner lining sheet and between the spacer system prior to positioning of the outer cladding sheet. Insulation to be installed according to the system manufacturer's installation instructions.

NBS Plus

Alternatively, consult the National Building Specifications, Standard version clause/clauses… H31/50, 254 and 271……

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

Built-up metal walls

Liner tray system

Earthwool FactoryClad Roll

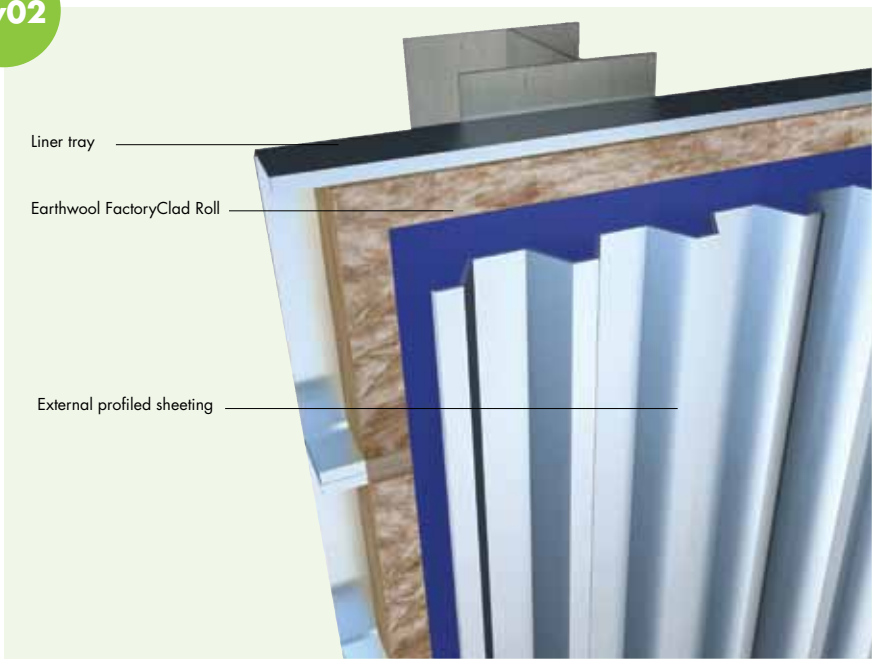
NEW BUILD

Bw02

- Interlocking nature of mineral wool ensures:
  Rolls knit together at joints ensuring no loss of thermal or acoustic performance
- Joints between rolls are closed, preventing air movement and infiltration through or around the insulation
- Lightweight cost effective solution

Earthwool FactoryClad Roll

- Non-combustible Euroclass A1 reaction to fire rating
- A+ Generic BRE Green Guide rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Earthwool FactoryClad Roll is a range of flexible, lightweight, non-combustible, resilient glass mineral wool quilts. They are manufactured in long lengths and have exceptionally high tear strength, making them particularly suitable for use in the walls of profiled metal clad buildings.

Typical construction

Profiled metal external sheets are fixed to the metal liner trays which incorporate a thermal break strip. Earthwool FactoryClad Roll is positioned within the troughs of the liner trays. An unventilated airspace of at least 25mm is maintained between the insulation and the external sheeting. Built-up metal walls and cladding systems are assembled on site and the design and components used are usually part of a proprietary system.

Installation

Liner trays are fixed horizontally to the structural steel members and sealed to minimise air leakage. Earthwool FactoryClad Roll is cut to size and installed in the liner trays, prior to fixing the external sheets. The profiled metal external sheets should be fixed as soon as possible after the Earthwool FactoryClad Roll has been installed, to avoid exposure to the weather.

Performance

Thermal performance

Earthwool FactoryClad Roll is produced in three different thermal conductivities as follows:

- Earthwool FactoryClad Roll 32 has a thermal conductivity of 0.032 W/mK
- Earthwool FactoryClad Roll 37 has a thermal conductivity of 0.037 W/mK
- Earthwool FactoryClad Roll 40 has a thermal conductivity of 0.040 W/mK

Knauf Insulation recommend that the system designer is contacted for specific U-value calculations.

Fire performance

Earthwool FactoryClad Roll is classified as Euroclass A1 to BS EN ISO 13501-1

Vapour resistivity

Earthwool FactoryClad Roll has a vapour resistivity of 7.00 MN.s.g.m.

Acoustic performance

Sound absorption: Achieved by perforating the metal liner sheet and incorporating a 'soft' absorbing insulation material behind it. Different combinations of perforations and levels of insulation will give varying results of sound absorption.

Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The acoustic performance can be increased by varying the number and the density of the insulation layers as well as adding additional mass into the construction.

Rain impact noise and flanking: System manufacturers have achieved significant impact noise reductions through the use of mineral wool insulation.

Environmental

Earthwool FactoryClad Roll's manufacture has a low impact on the environment and is classified as Zero ODP and Zero GWP.

Typical sections

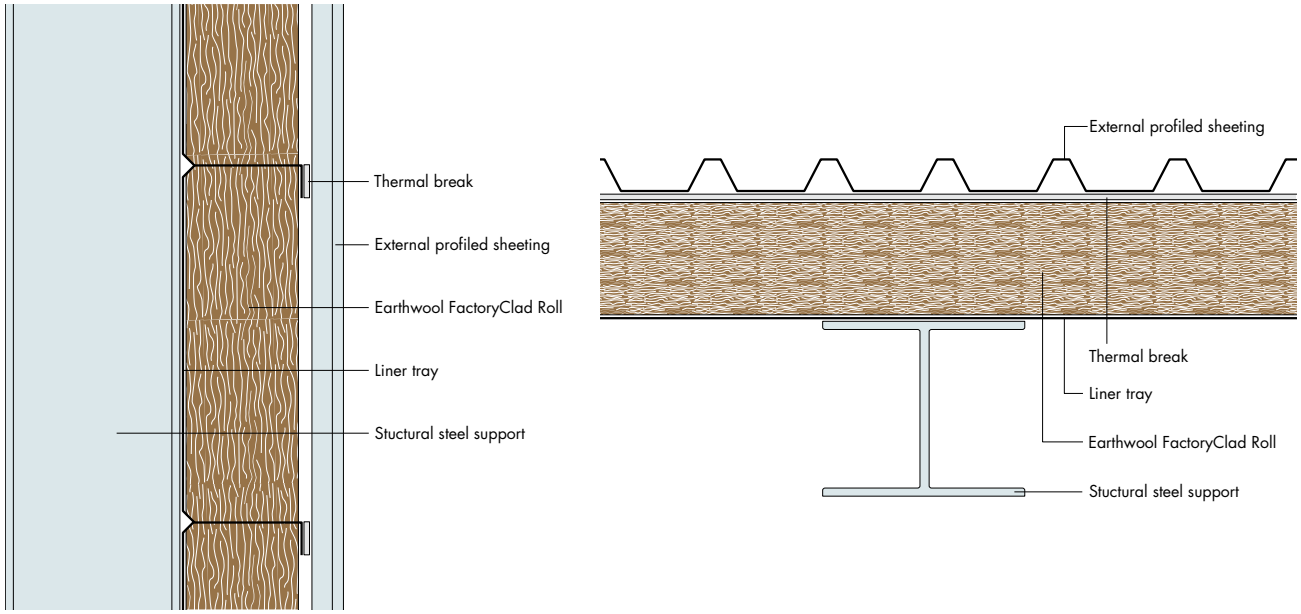


Table 21 - Typical U-values for liner tray systems

Product	Thickness (mm)	U-value (W/m²K)
Earthwool FactoryClad Roll 32	170	0.21
	160	0.22
Earthwool FactoryClad Roll 37	180	0.23
	160	0.26
	140	0.29
Earthwool FactoryClad Roll 40	160	0.27
	140	0.31
	130	0.33

Notes: The system manufacturer should be contacted for project specific U-value calculations. This U-value calculation table is outside the scope of the BBA/TIMSA Scheme for U-value Calculation Competency.

Typical specification

Wall liner trays: liner trays fixed horizontally to the vertical steel members – Earthwool FactoryClad Roll 32*/37*/40* ……mm thick, placed in the liner trays. Insulation should be cut to accommodate the tray dimensions and positioned in the tray prior to fixing the outer cladding. Insulation to be installed according to the system manufacturer's instructions.

Alternatively, consult the National Building Specifications, Standard version clause/clauses… H31/50, 254 and 271 ……

Knauf Insulation specification clauses can be downloaded from knaufinsulation.co.uk/nbs

KNAUF INSULATION

it's time to save energy

Disclaimer

Knauf Insulation have a policy of continuous product development, therefore product information may change without notice.

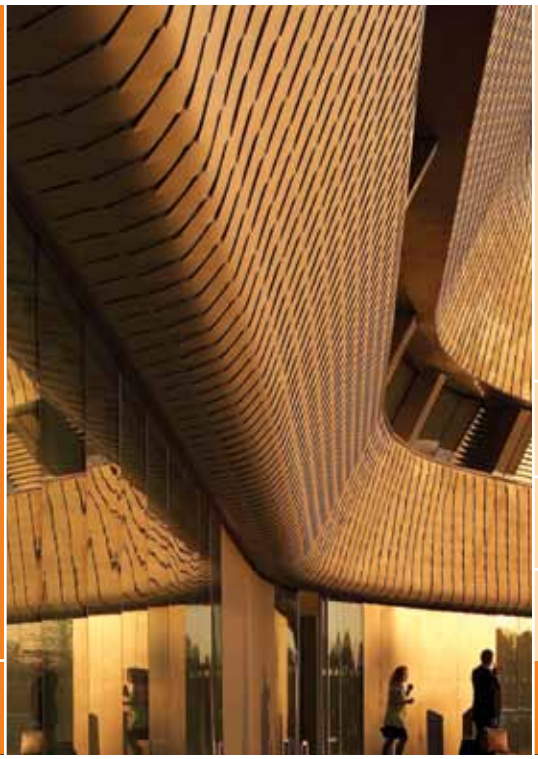
Wherever possible, products are manufactured to the appropriate British Standard (BS), or harmonised European Standards, (BS EN) and are supplied subject to our Terms and Conditions of Sale, a copy of which is available on request.

Information within this book

The designs and detailing shown in this publication are illustrative only, although every effort has been made to ensure the accuracy of all textual and pictorial content.

Knauf Insulation, its employees and authorised agents can accept no liability whatsoever, either indirectly or directly arising from the use of its products in connection with any information or advice contained in this book. It is the responsibility of Designers, Clients and Installers to check that installations achieve the appropriate standard and comply with the relevant Building Regulations. The most up to date British or European standards should be referenced at all times.

Ref: GB044312



Knauf Insulation Ltd
PO Box 10 Stafford Road
St Helens
Merseyside
WA10 3NS

Tel: 01744 766 600

Email: info.uk@knaufinsulation.com

www.knaufinsulation.co.uk

thinkinsulation.com

Knauf Insulation Ltd
PO Box 10
Stafford Road
St Helens
Merseyside
WA10 3NS

Customer Service (Sales)
Tel: 0844 800 0135
Fax: 01744 612007
Email: sales.uk@knaufinsulation.com
www.knaufinsulation.co.uk

Technical Advice and Support Centre
Tel: 01744 766 666
Fax: 01744 766 667
Email: technical.uk@knaufinsulation.com

Literature
Tel: 08700 668 660
Fax: 0870 400 5797
Email: info.uk@knaufinsulation.com