KNAUF INSULATION

it's time to save energy

June 2010

Non - Residential New Build

4.3.1 Built-up metal walls

energy saving | warmth | quietness | fire protection | sustainability

Non-residential New Build

Built-up Metal Walls Contents

Built-up metal walls

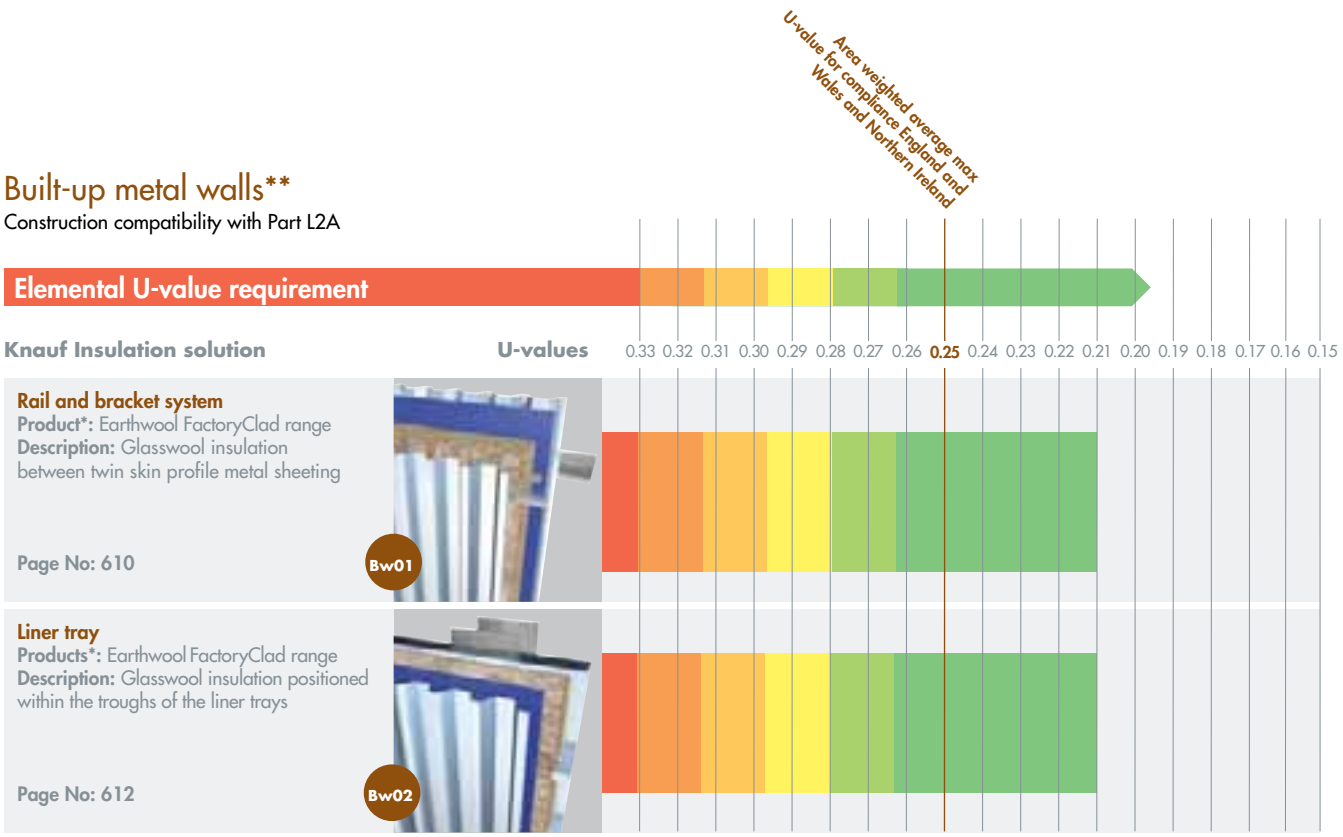
Solution optimiser and pathfinder

Built-up metal cladding systems have long been successfully used as a lightweight, fast and simple method of construction which can reduce both structural steel and foundation costs. Such systems offer a high performance, lightweight solution with A1 fire resistance, and are typically assembled on site with the design and components usually forming part of a proprietary system.

Knauf Insulation provides a range of external wall solutions giving options that will comply with the Building Regulations as well as meeting the preferred method of construction and required level of thermal performance.

Built-up metal walls**

Construction compatibility with Part L2A



Key

U-values achievable by constructions within this document.

* Recommended Knauf Insulation product(s). Other products may be applicable.

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

**Note: The above table shows typical U-values for built-up metal systems. Generic rail and bracket U-value calculations can be provided by our Technical Advisory 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

Built-up metal walls

Built-up metal wall design

Amongst the issues the designer should consider when designing a building with built-up metal walls, are the following, which both influence and are influenced by the insulation materials in the system.

- Thermal insulation
- Air permeability
- Thermal bridging
- Acoustic performance
- Fire safety
- Control of condensation

Thermal insulation

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 spacer systems it is not possible to calculate U-values using the normal simplified methods.

The Knauf Insulation Technical Advisory 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. Similarly, for standing seam systems, one should in the first place consult the system manufacturer.

Air permeability

The uncontrolled infiltration or leakage of air from a building has a significant impact on its energy efficiency. With good detailing and care in the construction phase it is possible to achieve very high standards of air tightness in built-up metal constructions. This will of course restrict uncontrolled air infiltration and leakage and improve the energy efficiency of the building. Building Regulations require a measurement of the air permeability to be included in the SBEM whole building calculation used for compliance. Problem areas include at the junction of building elements such as the wall roof junction 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 the spacer system and the thermal bridges at junctions and openings in the construction. The effect of the repeating thermal bridges is included in the U value calculation for the roof. Thermal bridges at junctions and openings must be calculated separately and the heat losses at these points included in the SBEM calculation. This value is included by multiplying the length of each thermal bridge by the calculated 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 roof will transmit a significant amount of sound, whether it be airborne sound or rain noise (the drumming sound that heavy rainfall can cause), which will lead to the building failing to provide an acceptable level of protection either to the occupants of the building (in the case of either noise outside the building or rain noise) or to people living close to the building from noise generated within the building.

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 two sides of the roof and also include glass and rock mineral wool within the structure which provide very high levels of sound absorption. When the effects of separation and sound absorption are combined in a built-up metal roof it is possible to achieve outstanding levels of sound insulation.

Health and Education requirements

Building regulations impinge primarily on external walls in respect of 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 roof will include noise from road, rail and air traffic, industrial and commercial premises.

The performance required in other types of buildings may be controlled by government requirements such as Hospitals under HTM 2045, or specific client requirements. Environmental Health Regulations may require specific sound insulation performance in external walls where high levels of noise are generated, such as industrial buildings, 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 with sound absorbing lining, usually glass or rock mineral wool, to control reverberation of sound 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. Addressing this issue has created focus on the governmental Building Schools for the Future programme. Future intention is that rain noise will be considered within BB93. 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.

Built-up metal walls have the advantage of using non combustible glass and rock mineral wool insulation.

Control of condensation

Condensation could potentially occur either on the underside of the liner sheet if there were significant thermal bridges through the system or within the structure of the system if there was a significant break in the vapour control layer

The spacer system used to support the outer cladding sheet is a potential thermal bridge and thus could be a point for localised condensation on the liner sheet, however the modern spacer systems all include a significant thermal break, as a necessity for the achievement of the overall U-value, and as such the chance of condensation where the spacer system is fixed to the liner is negligible. If there are significant gaps in the insulation layer then it would be possible that localised condensation would occur.

To control condensation within the built-up metal roof structure it is normal to create an effective vapour barrier at the level of the liner sheet. This is done by sealing all joints in the liner sheet and where there are any penetrations through the liner sheet. Where a perforated liner sheet is used then a separate vapour barrier must be installed.

The likelihood of either problem occurring is very low however extra care needs to be taken in buildings with high levels of humidity such as swimming pools or certain industrial processes.

Image courtesy of Hufton and Crow

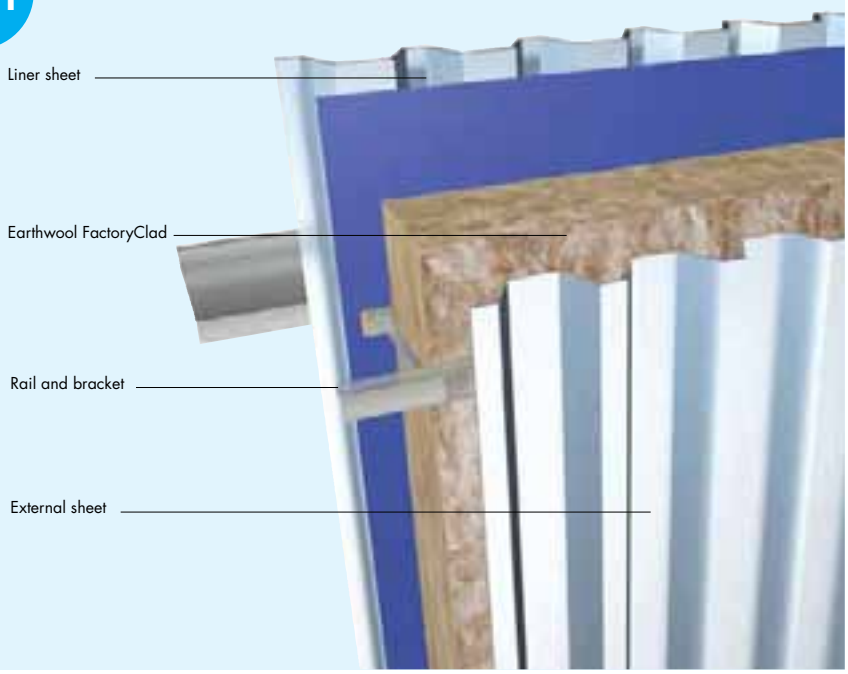
Built-up metal walls

Rail and bracket systems

Bw01

Advantages

- ✓ **Strong and easy to assemble**
- ✓ **Quick and economical to install**
- ✓ **Easy to adapt and upgrade**
- ✓ **Energy efficient**
- ✓ **Speeds up building program**
- ✓ **Lightweight**
- ✓ **Secure and weatherproof at an early stage in the programme**
- ✓ **Non-combustible insulation**
- ✓ **Earthwool FactoryClad products have zero GWP and zero ODP**
- ✓ **The manufacture of Earthwool FactoryClad has a very low impact on the environment**



Products

Earthwool FactoryClad Roll is a flexible, lightweight, non-combustible, resilient glass mineral wool quilt. It is manufactured in long lengths and has an exceptionally high tear strength, making it particularly suitable for use in the walls of profile metal clad buildings.

Typical construction

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

Earthwool FactoryClad 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 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 insulation 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 insulation, to avoid exposure to the weather.

Performance

Thermal performance

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

Earthwool FactoryClad 35 has a thermal conductivity of 0.035 W/mK

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

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

Vapour resistivity

Earthwool FactoryClad 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.

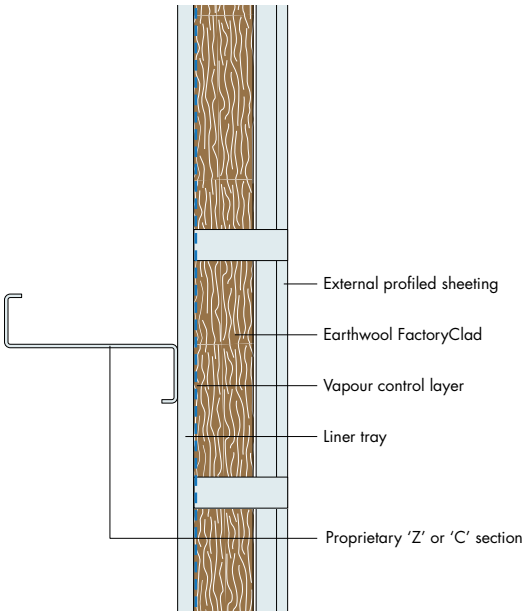
Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The acoustic performance can be increased by varying the number and the densities of the insulation 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's manufacture has a low impact on the environment and is classified as Zero ODP and Zero GWP.

Typical sections



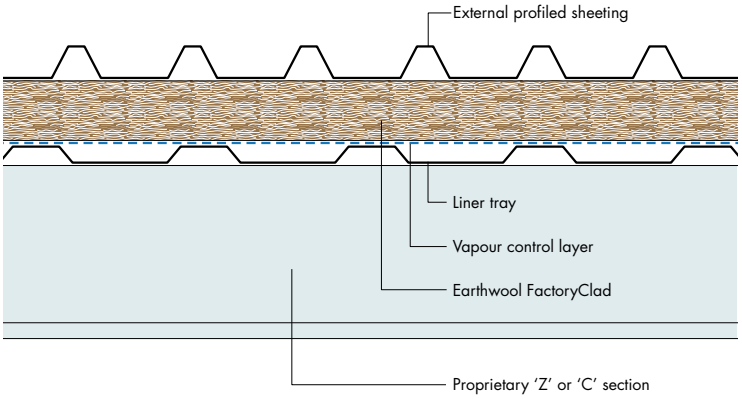


Table 58: Insulation thickness for rail and bracket systems

Product	Rails at 1.20 metre spacings	
	Thickness (mm)	U-value (W/m^2K)
Earthwool FactoryClad 40	160	0.27
	140	0.31
	130	0.33
Earthwool FactoryClad 37	180	0.23
	160	0.26
	140	0.29
Earthwool FactoryClad 35	140	0.27
	130	0.29
	120	0.32
	110	0.35
Earthwool FactoryClad 32	170	0.21
	160	0.22

Notes: These U-values are based on SCI P312. Generic rail and bracket U-value calculations can be provided by our Technical Advisory 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. For other sheeting rail spacings, contact Knauf Insulation or the metal profile system manufacturer.

Typical specification

Earthwool FactoryClad 32*/35*/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.

NBSPlus Alternatively, refer to NBS clause H31/50, 254 and 271.

(*Delete as appropriate)

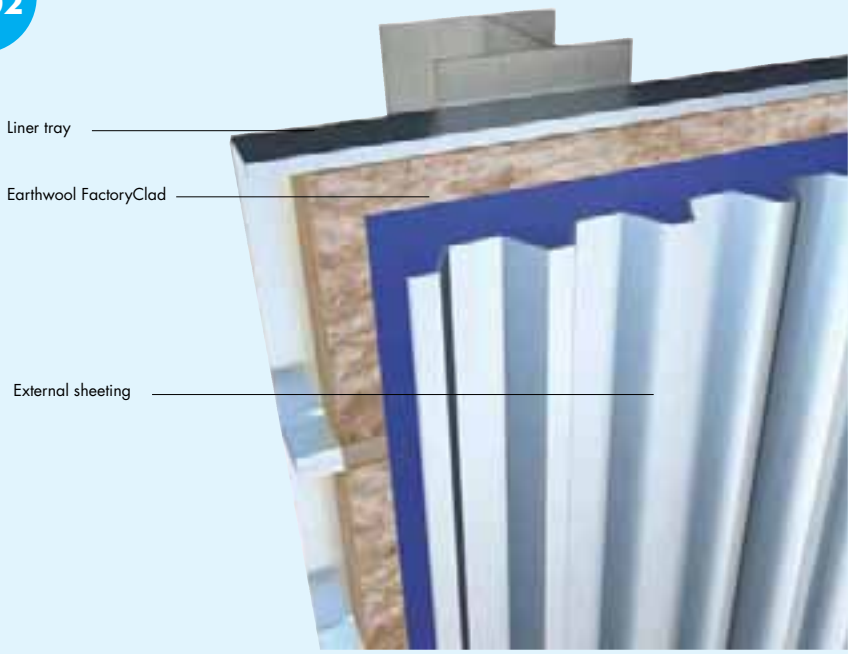
Built-up metal walls

Liner tray system

Bw02

Advantages

- ✓ **Versatile system**
- ✓ **Non-combustible insulation**
- ✓ **Easy to install**
- ✓ **Fast track construction method**
- ✓ **Reduces building costs**
- ✓ **Secure and weatherproof at an early stage in the build programme**
- ✓ **Reduces project completion times**



Products

Earthwool FactoryClad is a flexible, lightweight roll of resilient, non-combustible glass mineral wool with exceptionally high tear strength, making it particularly suitable for use in profiled metal clad wall construction methods.

Typical construction

Profiled metal external sheets are fixed to the metal liner trays which incorporate a thermal break strip. Earthwool FactoryClad is positioned within the troughs of the liner trays.
An unventilated airspace of at least 25mm is maintained between the insulation and the external skin. 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 is cut to fit in the liner trays, and positioned in the trays prior to fixing the outer external cladding sheets. The profiled metal external sheets should be fixed as soon as possible after the Earthwool FactoryClad insulation has been installed, to avoid exposure to the weather.

Performance

Thermal performance

Earthwool FactoryClad is produced in four different thermal conductivities as follows:

- Earthwool FactoryClad 40 has a thermal conductivity of 0.040 W/mK
- Earthwool FactoryClad 37 has a thermal conductivity of 0.037 W/mK
- Earthwool FactoryClad 35 has a thermal conductivity of 0.035 W/mK
- Earthwool FactoryClad 32 has a thermal conductivity of 0.032 W/mK

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

Table 59 gives thicknesses of insulant required to achieve specific U-values.

Fire performance

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

Vapour resistivity

Earthwool FactoryClad 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.

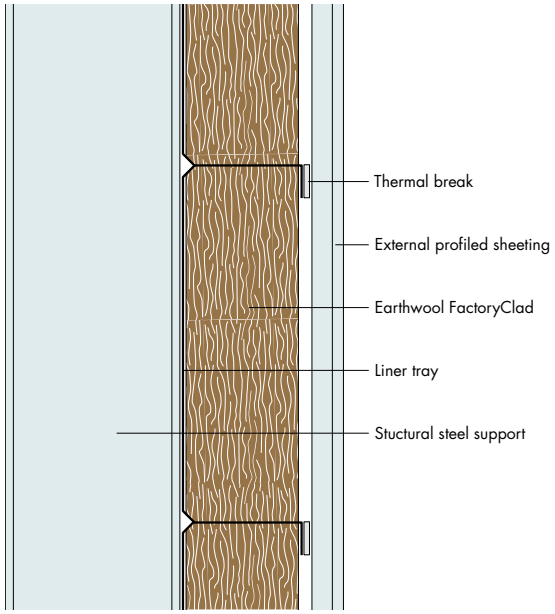
Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The acoustic performance can be increased by varying the number and the densities of the insulation 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's manufacture has a low impact on the environment and is classified as Zero ODP and Zero GWP.

Typical sections



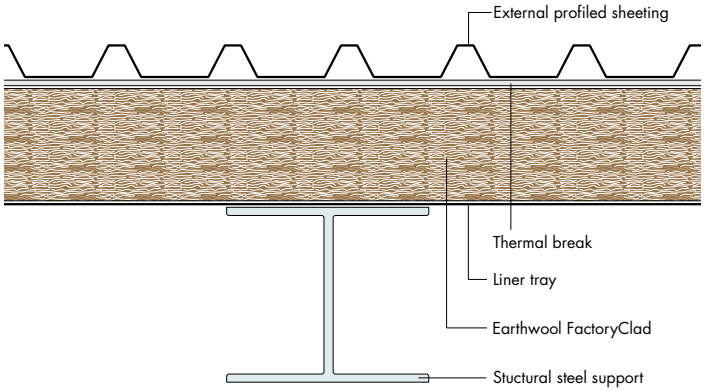


Table 59: Typical insulation thickness for liner tray systems

Product	Thickness (mm)	U-value (W/m²K)
Earthwool FactoryClad 40	160	0.27
	140	0.31
	130	0.33
Earthwool FactoryClad 37	180	0.23
	160	0.26
	140	0.29
Earthwool FactoryClad 35	140	0.27
	130	0.29
	120	0.32
	110	0.35
Earthwool FactoryClad 32	170	0.21
	160	0.22

The system manufacturer should be contacted for project specific U-value calculations

Typical specification

Wall liner trays: liner trays fixed horizontally to the vertical steel members – Earthwool FactoryClad 40*/37*/35*/32* ……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.

NBS Plus

Alternatively, refer to NBS clause H31/50, 254 and 271.

(*Delete as appropriate)

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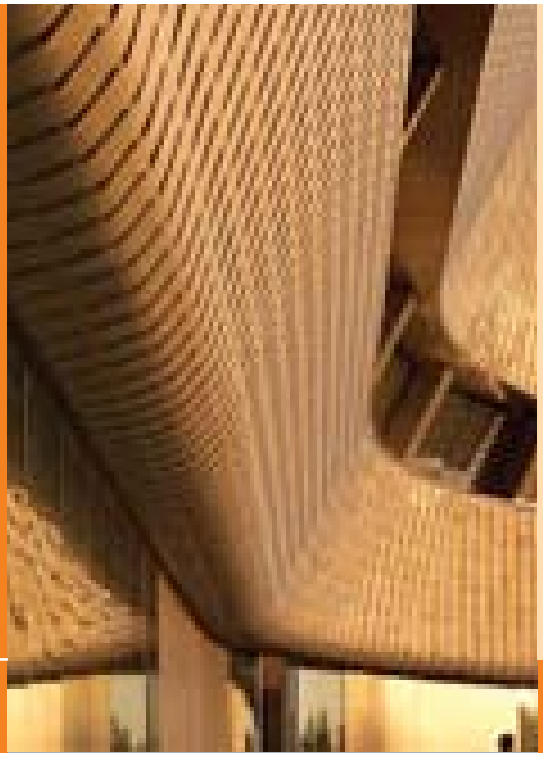

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