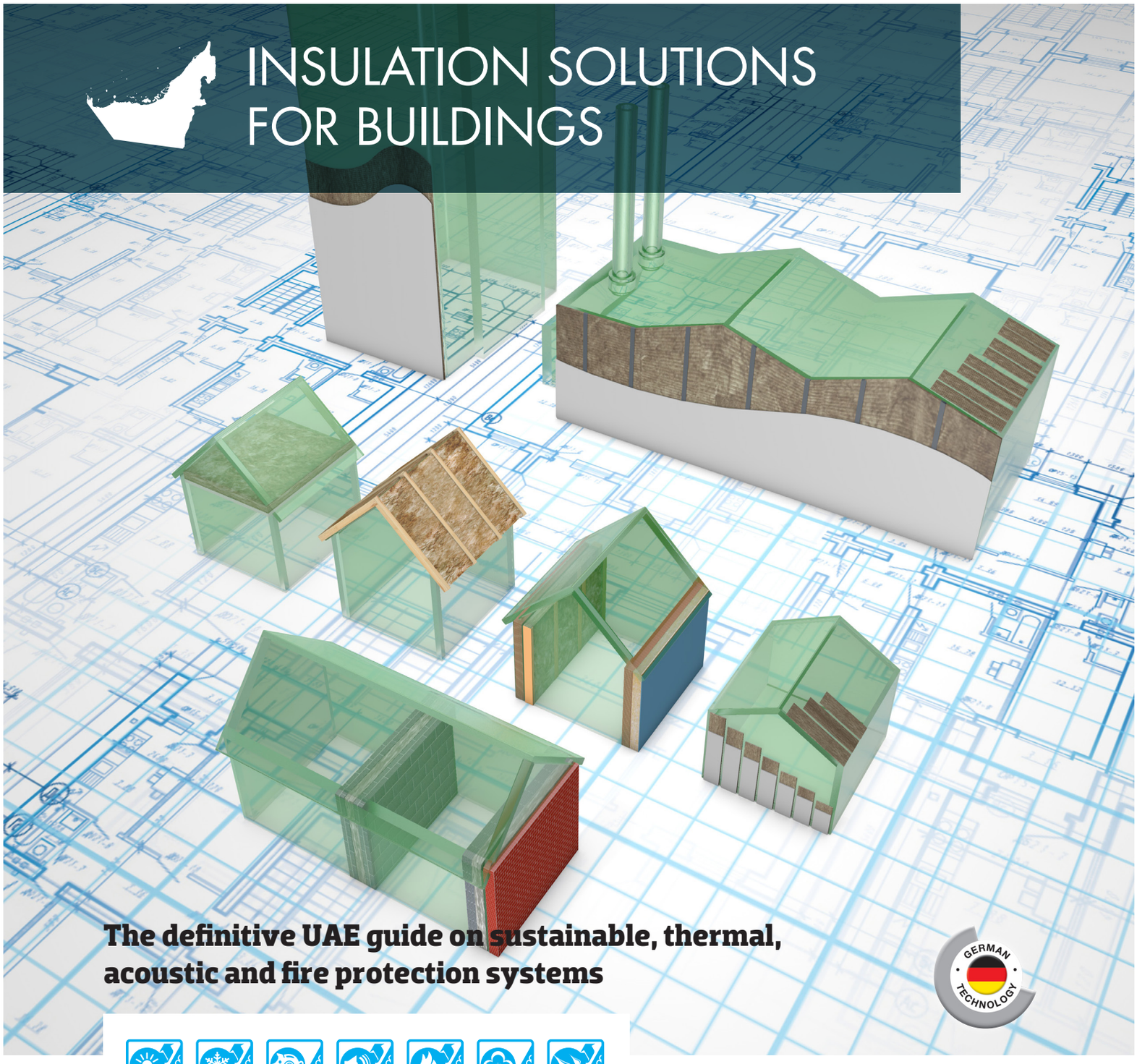
KNAUF INSULATION

www.knaufinsulation.ae

INSULATION SOLUTIONS FOR BUILDINGS



The definitive UAE guide on sustainable, thermal, acoustic and fire protection systems

GERMAN TECHNOLOGY

Thermal | Thermal | Energy saving | Acoustic | Fire protection | Sustainability | Moisture resistance

challenge.
create.
care.

ABOUT KNAUF INSULATION

Knauf Insulation is part of the Knauf Group of Companies, a family owned global building material business established in 1932.

As a global player and part of an international operating family company, Knauf Insulation can now look back at more than 30 years of company history. Since the founding of Knauf Fiber Glass in Shelbyville (USA) in 1978, the company is achieving annual sales of 1.6 billion Euros. Today Knauf Insulation has over 5,500 employees in more than 35 countries with more than 40 production plants in 15 countries.

The Knauf Insulation business in the Middle East supplies a wide range of glasswool insulation products, along with design services for any building project. With state-of-the-art proprietary technology, we produce insulation of the very highest quality and aim to provide customer service to continually enhance industry standards. Knauf Insulation is committed to sustainable development and conservation of the environment manufacturing its products from recycled materials.

Recognizing that Middle East has unique climatic conditions and therefore specific insulation requirements, Knauf Insulation provides a range of products to suit local construction methods and proven solutions to provide comfort and energy efficiency in buildings. Long term, equal value partnerships with our customers are an important part of our approach. With continual advancements in regulations for energy efficiency, acoustic performance, fire resistance and sustainable building materials, we are constantly enhancing our product range.

TECHNICAL SUPPORT TEAM

Our Technical Support Team Team provides personal, high level technical support. This includes U-value calculations, condensation analysis and assistance with CAD drawings from the most experienced team of advisors in the insulation industry. For further information, please call us at +971 2 551 2453 or drop us an email at technicalsupport@kei.ae

U value calculation

Calculations produced by Knauf Insulation's Technical Services Department are as per Dubai Municipality and ESTIDAMA norms.

Acoustic Study

In order to make sure the right insulation is used to improve acoustic performance of the applications we can assist with providing acoustic reports using INSUL 8.0 software for predicting the acoustic insulation of walls, floors and ceilings.

Condensation analysis

Thickness is a critical factor in the success or failure of an insulation system. Determining the appropriate mineral wool insulation thickness for a particular application can be challenging and a number of factors must be tken into account. Our technical support team can perform a Condensation Risk Analysis based on NAIMA's 3E Plus software®.

Heat Flow Calculation

Knauf Insulation can help to model an estimation of the heat flow through insulation for flat and cylindrical systems given the temperatures on each side and the effective conductivity of the insulation material. NAIMA's 3E Plus software is designed to allow the user to easily calculate heat losses and to determine surface temperatures on hot and cold piping and equipment. 3E Plus uses the heat flow calculation method described in ASTM C680: Standard Practices for Determination of Heat Gain or Loss and the Surface Temperature of Insulated Piping on Equipment Systems.

On Site Project Support

Knauf Insulation Technical Team offers assistance on system design, product selection, specification and installation advise.

OUR COMMITMENT TO SUSTAINABILITY

Our guiding principles:

As a family-owned company, we're proud of the Knauf Insulation name and what it represents.

Customers worldwide have put their trust in the quality, consistency and performance of our products and our business values. So, everyone who does business with us recognises the importance that, in our quest to become more sustainable, there are certain principles that we will not compromise:

- The quality, consistency, and performance characteristics for which our products are known.
- Our ability to apply technological advances across all product lines.
- The safe and efficient manufacture of our products.
- Our commitment to sustainability from plant operations.
- Our commitment to cost-effectively produce our products.

Manufacturing improvements

- In our operations, we look for ways to advance our glass formulations to increase the use of post-consumer recycled glass bottles in all our products.
- To reclaim and reuse vented heat and to control emissions, we have invested millions of dollars in regenerative thermal oxidisers and the best available technology for pollution control.
- By converting our products to ECOSE® Technology, we have eliminated chemicals like phenol and formaldehyde from the manufacturing process, eliminating their plant emissions. This has the added benefit of providing a safer workplace environment both in production and for installers.

with ECOSE® TECHNOLOGY

THE NEW GENERATION OF GLASS MINERAL WOOL

Knauf Insulation mineral wool with ECOSE® Technology offers superior handling...

with ECOSE® TECHNOLOGY

Our mineral wool with ECOSE Technology doesn't look or feel like any insulation you have ever experienced.

...superior level of sustainability...

The natural brown colour represents a level of sustainability never achieved before:

- Manufactured from naturally occurring and/or recycled raw materials, and bonded using a bio-based technology which is free from phenols, acrylics and with no added formaldehyde, artificial colours, bleach or dyes.
- Contributes to improved indoor air quality compared to our conventional mineral wool
- Reduces impact on environment with lower embodied energy
- Reduces pollutant manufacturing emissions and workplace exposures
- Improves the overall sustainability of buildings in which they are incorporated
- Cost competitive with traditional mineral wool

...and delivers all the benefits of our traditional mineral wool!

Thermal insulation properties, fire resistance, fire classification, acoustical insulation, sound absorption and mechanical properties as well as the high levels of recycled content are maintained, with improved product durability.

ECOSE Technology is a revolutionary, no-added formaldehyde binder technology, based on rapidly renewable materials instead of petro-based chemicals. It reduces embodied energy and delivers superior environmental sustainability.

ECOSE Technology was developed for glass and rock mineral wool insulation, but offers the same potential benefits to other products where resin-substitution would be an advantage, such as in wood based panels, abrasives and friction materials.

www.ecose-technology.com

with ECOSE® TECHNOLOGY

challenge. create. care.

KNAUF INSULATION

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BUILDING REGULATIONS

Emirate of Abu Dhabi

Governing Body

- Department of Municipal Affairs (DMA)
- Ministry of Interior Civil Defense G.H.Q

Legislative framework

- Abu Dhabi International Building Code
- Abu Dhabi International Energy Conservation Code
- UAE Fire and Life Safety Code of Practice

Intent

The Abu Dhabi Building Codes, launched by the Department of Municipal Affairs (DMA), is a complete set of comprehensive and coordinated codes dealing with construction safety and fire protection, among other issues. They are aimed at improving the construction standards for buildings in Abu Dhabi. The new unified building codes introduce a common and transparent set of regulations to govern all construction industry activities throughout the Abu Dhabi Emirate.

The codes are applicable to all projects in Abu Dhabi, including all private and commercial projects, which submit permit applications with the required supporting documents after the date for mandatory compliance. However, the codes do not apply retroactively to existing buildings unless the property owner submits an application to carry out improvements to the existing structure.

Emirate of Dubai

Governing Body

- Dubai Municipality
- Ministry of Interior Civil Defense G.H.Q
- Trakhees – Ports, Customs & Freezone Corporation
- TECOM (Regional Specification)

Legislative framework

- Al Sa'fat Green Building Rating System
- EHS Regulations
- UAE Fire and Life Safety Code of Practice

Intent

In line with the commitment of Dubai to become a world leading 'green' city and to make Expo 2020 an environmentally sustainable event, Dubai Municipality recently issued a circular making the existing Green Building Regulations and Specifications ("Green Building Regulations") mandatory for the private sector. The Green Building Regulations were issued by Dubai Municipality in 2011 and were immediately mandatory for government bodies and optional for private developers. Following the publication of Dubai Municipality Circular No. (198) of 2014, the Green Building Regulations are now also mandatory for all private developments with effect from 1 March 2014.

PRODUCT ACCREDITATIONS

Knauf Insulation Products are certified for

ASTM E84

Surface burning characteristics of materials using the Steiner Tunnel. This certification covers products which are Unfaced, FSK Facing and WGF Facing

BS 476, part 4,6,7

Fire propagation. This certification covers products which are Unfaced

UL 723

Surface Burning Characteristics for Building Materials. This certification covers products with are with FSK facing, WMP facing and ASJ facing.

EUCEB

Fibers produced with the requirements of Note Q of the Regulation (EC) No 1272/2008 of the European Parliament and of the Council.

Eurofins

Indoor Air Comfort Gold

DCL

For BS EN 13162 and ASTM C547-12

SASO

For product conformity

In addition to the product certifications all our products are tested to variety of performance tests. Please contact Knauf Insulation Technical Support Team for further details.

BUILT-UP METAL ROOFS

Introduction

Profiled metal roofing systems typically consist of a low profile metal inner liner sheet, separated from an outer, higher profile, metal weather sheet. The cavity between them is filled with a layer of thermal insulation to provide the specified level of thermal performance.

The insulation is normally a lightweight, high performance, non-combustible glass mineral wool quilt, with a Euroclass A1 fire rating. Built-up metal roofing systems are typically assembled on site with the design and components used forming part of a proprietary system.

Design considerations

The designer will have to consider many things when designing a building with a built-up metal roof. The following 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
- Environmental impact of the materials

Thermal insulation

It is possible to achieve very high levels of thermal insulation using built-up metal systems, 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.

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 roofs. This will of course restrict uncontrolled air infiltration and leakage and improve the energy efficiency of the building.

Thermal bridging

There are two categories of thermal bridging that occur in built-up metal systems, 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.

Acoustic performance

Buildings with built-up metal roofs 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

Incorporating glass mineral wool insulation within a built-up metal roof system is one of the most cost effective methods of improving its sound insulation performance. 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.

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 or specific client requirements. Environmental health regulations may require specific sound insulation performance in roofs where high levels of internal noise are generated, such as industrial buildings and sports and concert halls in order 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 and a sound absorbing lining (usually glass mineral wool) to control reverberation of sound which would otherwise be problematic.

Fire protection

Glass mineral wool is non-combustible with a Euroclass A1 `Reaction to fire` classification. 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 is available from roof system manufacturers.

Control of condensation

In order to achieve the overall U-value the modern spacer systems are likely to include a significant thermal break, and as such the chance of condensation 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 condensation to occur.

To control condensation within the built-up metal roof structure it is normal to create an effective vapour control layer at the level of the liner sheet. This can be achieved by installing a separate vapour control layer (polythene sheet) or sealing all joints and penetrations in the metal liner sheet. Where a perforated liner sheet is used then a separate vapour control layer must be installed.

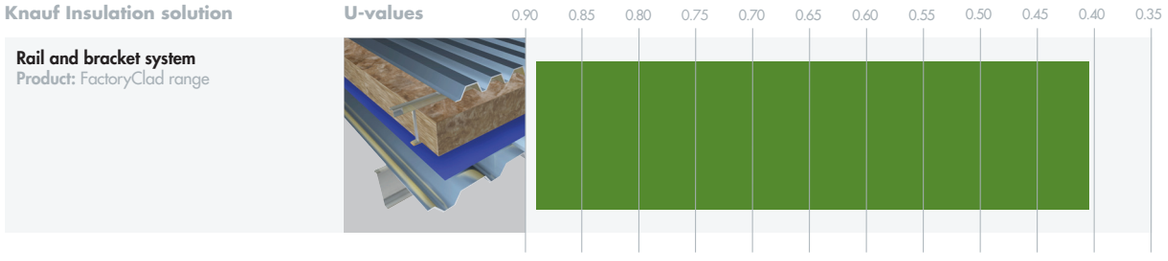
The likelihood of either problem occurring is very low, however, extra care needs to be taken in buildings with high levels of humidity such as swimming pools or food processing plants.

Photograph Courtesy of Kalzip

Photograph courtesy of Kalzip

Photograph courtesy of Kalzip

Solution optimiser and pathfinder



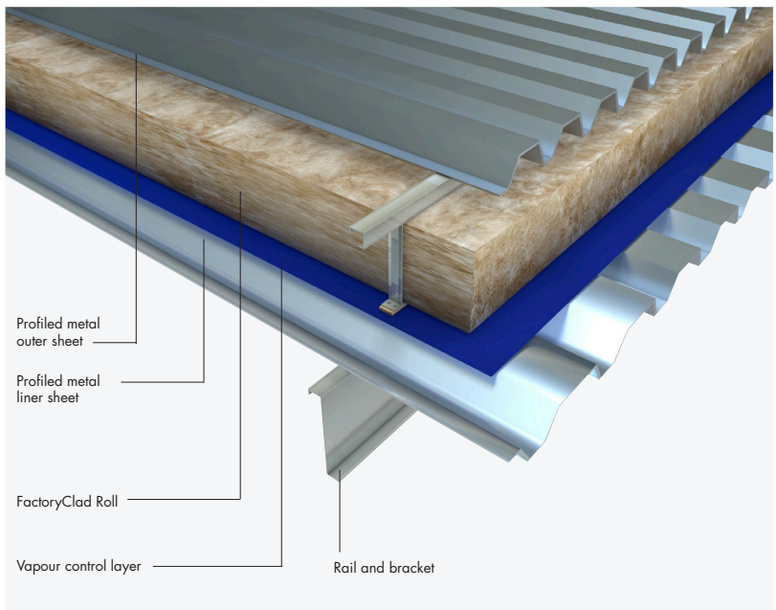
KNAUF INSULATION

BUILT-UP METAL ROOFS
RAIL AND BRACKET SYSTEM

NEW BUILD ✓ REFURB ✓

FactoryClad Roll

- **Significantly improves acoustic performance**
- **Insulation knits together at joints ensuring no loss of thermal and acoustic performance**
- **Lightweight, easy and quick to install**



FactoryClad Roll

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)

Products

FactoryClad Roll is a range of flexible, lightweight rolls of resilient, non-combustible glass mineral wool with exceptionally high tear strength.

They have a very low impact on the environment and are produced in a range of three thermal conductivities.

Typical construction

FactoryClad Roll is used for the thermal and acoustic insulation in profiled metal clad roofing systems.

Installation

FactoryClad Roll is located between the profiled metal outer cladding sheets and inner lining sheets. The lining sheets are fixed on top of the supporting purlins. The inner and outer metal cladding sheets are separated by rail and bracket systems or preformed insulated spacer systems.

To maintain continuity of the insulation where rail and bracket systems are used, the insulation is tucked under the rails, with all quilt edges tightly butted. There is no continuous airspace in the construction other than that created by the cladding profiles.

Performance

Fire performance

FactoryClad Roll is tested and listed UL 723, ASTM E84

Classification (UL723)	FSK	WMP-10
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

Vapour Resistivity

FactoryClad insulation with WMP-10 facing has a vapour transmission of 0 perms

FactoryClad insulation with FSK facing has a vapour transmission of 0.02 perms

Acoustic performance

Sound absorption: Achieved by installing a perforated metal liner sheet and incorporating a 'soft' absorbing insulation material behind it, such as FactoryClad Roll. Different combinations of perforations and levels of insulation will give varying results of sound absorption.

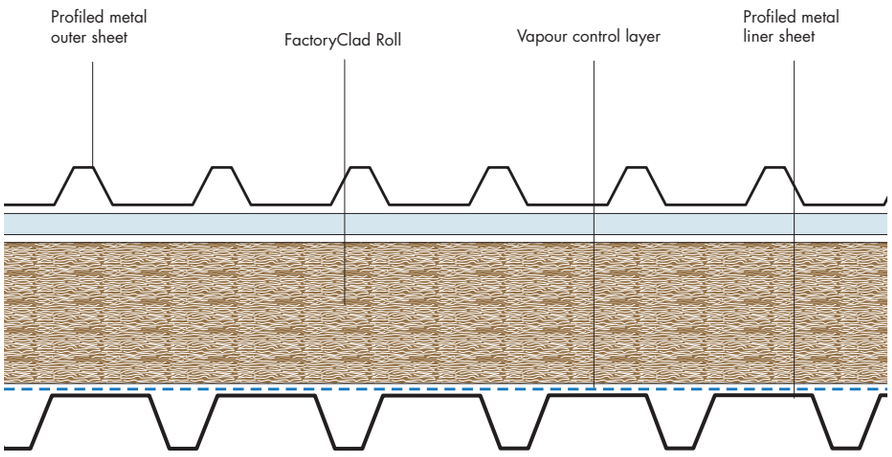
Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The sound reduction performance can be increased by varying the number and the density of the insulation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

Thermal performance

FactoryClad Roll 44 Roof as a thermal conductivity of 0.044 W/mK.

FactoryClad Roll 41 has a thermal conductivity of 0.041 W/mK.

Typical section



Product	Rails at 1.20 metre spacings	
	Thickness (mm)	U-value (W/m²K)
FactoryClad Roll 44 Roof	100	0.44
	50	0.88
FactoryClad Roll 41	100	0.41
	50	0.82

Note: Knauf Insulation recommend that the system designer/manufacturer is contacted for U-values specific to their systems.

Typical specification

Liner panels to be positioned over purlins and a metal spacer system secured to the liner and purlin to ensure the full thickness of insulation is maintained between the liner and cladding sheets.

FactoryClad Roll 44*/41* .....mm thick, to be laid over the lining sheets and installed according to system manufacturer's instructions, with all joints closely butted. Cladding sheets to be securely fixed in position. (*Delete as appropriate)

DriTherm Slab

Wall ties

Apart from structural considerations, which are obviously pre-eminent, the correct specification of wall ties is crucial in two additional respects. Firstly, it is necessary that the tie does not compromise the performance of the cavity wall insulation with regard to liquid water penetration.

Secondly, the U-value calculation method must take into consideration the number of wall ties per square metre as well as the cross sectional area, and thermal performance of the wall tie.

Stainless steel wall ties can be used for cavities up to 175mm and are recommended because they have a low cross sectional area minimising their impact on the thermal performance of the wall. Where wider cavities are used a two part wall tie is recommended. These are more robust and can have a significant impact on the U-value of the wall. In all circumstances it is recommended that the designer seeks advice from the manufacturer of the wall tie to ensure that the tie selected meets the structural requirements of the building work.

Low thermal conductivity wall ties are also available and are suitable for cavities up to 300mm wide, their thermal performance is such that they have negligible impact on the U-value of the wall.

Prevention of liquid water penetration

Prevention of liquid water penetration from the outer to inner leaf is one of the major considerations when designing cavity walls.
The selection of appropriate materials and jointing methods for the outer leaf are crucial.

Cavity trays

Cavity trays should be provided:

- At all interruptions of the cavity, such as lintels and sleeved vents and ducts
- Above cavity insulation that stops short of the top of the wall

Cavity trays should rise at least 140mm within the cavity, be self-supporting or fully supported with joints lapped and sealed. Stop ends should be provided to the ends of all cavity trays. Weep holes should be provided at not more than 900mm centres to drain each cavity tray with at least two weep holes per cavity tray.

Condensation risk

In a properly insulated masonry cavity wall there is negligible risk of condensation forming on the inner block leaf.

Condensation may have a detrimental effect on the thermal performance of a structure or cause damp on the warmer face of the wall. Un-faced mineral wool products, being 'vapour open' offer negligible resistance to the passage of water vapour through the wall.

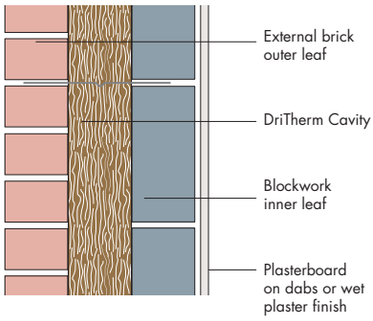
The Knauf Insulation Technical Support Team are able to carry out condensation risk calculations if further reassurance is required.

Recommended solutions

The recommended masonry cavity wall solution is full-fill built in slabs (DriTherm Cavity).

These systems not only provide the best U-value to wall width ratio but are also the lowest in cost. Even with dense concrete blocks it is possible to achieve very high thermal performance in a manageable wall width.

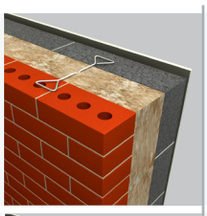
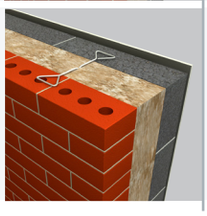
1) Full-fill: built-in



Solution optimiser and pathfinder

Key

Thermal insulation achievable by constructions within this document.

Knauf Insulation solution	U-values	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15	0.09
Full-fill with built-in glass mineral wool **Product:** DriTherm Cavity 38											
Full-fill with built-in glass mineral wool **Product:** DriTherm Cavity 35											

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KNAUF INSULATION

MASONRY CAVITY WALLS
FULL-FILL WITH BUILT-IN GLASS MINERAL WOOL

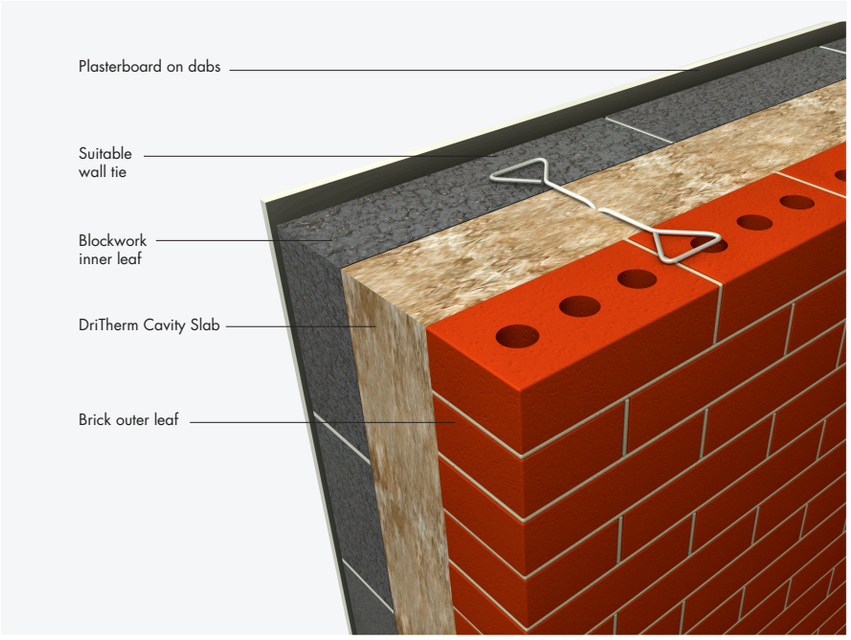
DriTherm Cavity Slabs and Rolls

NEW BUILD

- **Slabs fully fill the cavity and knit together at joints, preventing air movement and infiltration through or around the insulation**
- **Slabs are installed under compression, preventing moisture penetration and cold bridging at joints**
- **Low cost, quick and easy to install**

DriTherm Cavity Slabs

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

DriTherm Cavity Slabs and Rolls are a range of lightweight semi rigid or rigid slabs of glass mineral wool with a water repellent additive. They are manufactured to fit between wall ties at standard vertical spacings.

Typical construction

Brick or block outer leaf (which may be rendered), brick or block inner leaf with cavity fully filled with DriTherm Cavity. Internal finish of 12.5mm standard plasterboard on dabs.

For additional information contact our Technical Support Team Centre on +971 2 551 2453.

Installation

DriTherm Cavity should be kept clean and free from mortar droppings. All joints should be closely butted. Any cutting and fitting should be neatly done and not distort the layers of glass mineral wool which comprise the product. Damp proof courses should be installed to ensure that penetrating water is directed only to the outer leaf.

Performance

Thermal performance

DriTherm Cavity Roll 38 Standard has a thermal conductivity of 0.038 W/mK.

DriTherm Cavity Slab 35 Super has a thermal conductivity of 0.035 W/mK.

Fire performance

Unfaced DriTherm insulation is A1 non-combustible.

DriTherm is tested and listed UL 723, ASTM E84

Classification (UL723)	Unfaced	FSK
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

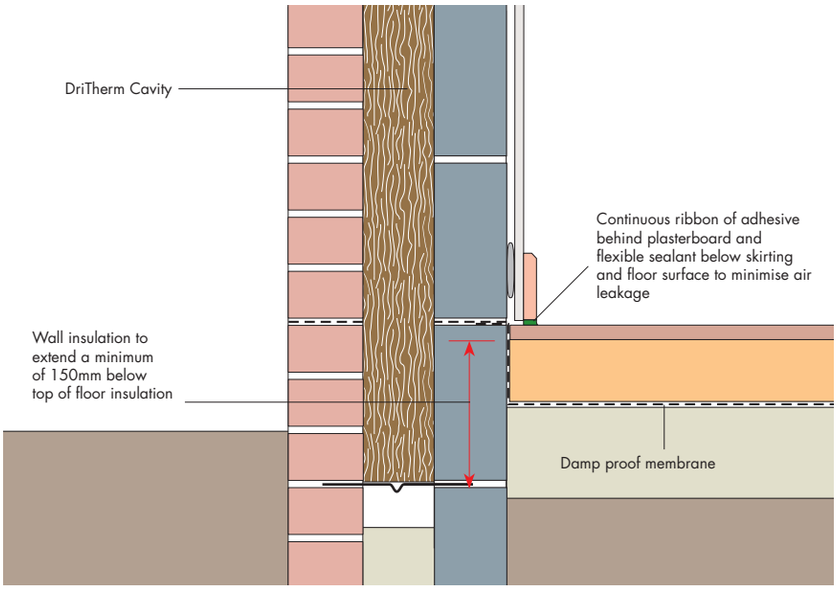
Moisture resistance

DriTherm Cavity contain a water-repellent silicone additive to ensure that no liquid water is able to pass through the slabs and reach the inner leaf of masonry.

Vapour resistance

DriTherm Cavity have negligible water vapour resistance, allowing water vapour to pass freely through the slabs.

Typical wall/ground floor junction



Typical specification

All external walls to be insulated during construction by completely filling the cavity with DriTherm Cavity 38*/35* .....mm thick. (*Delete as appropriate).

The first run of wall ties to be located at 600mm centres horizontally at a level to be determined by the specifier. Subsequent runs of wall ties to be at not more than 900mm centres horizontally, or as otherwise required by the structure, and at 450mm vertically.

U-values (W/m²K) 100mm outer leaf/cavity/100mm block inner leaf, plasterboard

Cavity width (mm)	Product	Masonry Hollow Normal Weight Block (λ = 1.13)	Masonry Solid Normal Weight Block (λ = 1.69)	Lightweight Autoclave Aerated Concrete (AAC) Block (λ = 0.13)	High strength Autoclave Aerated Concrete (AAC) Block (λ = 0.16)
100	DriTherm 38	0.36	0.36	0.24	0.26
	DriTherm 35	0.33	0.34	0.23	0.24

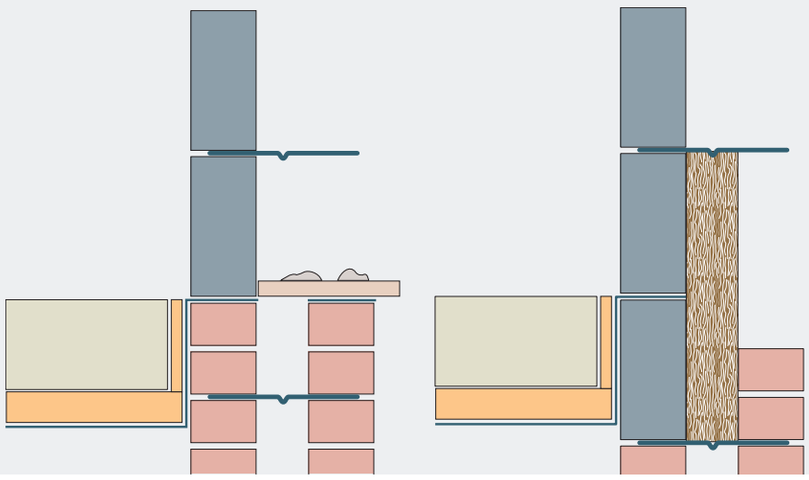
KNAUF INSULATION

MASONRY CAVITY WALLS
FULL-FILL WITH BUILT-IN GLASS MINERAL WOOL

Installation sequence

1 Build up the first stage of one leaf of masonry to include the first row of ties above the commencement of the DriTherm Cavity. Clean mortar squeeze from the masonry and snots from any ties or cavity tray.

2 Position the DriTherm Cavity against the masonry, so that the wall tie drips are halfway across the top edge of the slabs. The DriTherm Cavity should be cut to course if necessary. DriTherm Cavity should be taken below DPC level (preferably by at least 150mm) to provide edge insulation, with no risk of capillary action. DriTherm Cavity does not wick. Always bring DriTherm Cavity to course with wall ties.



Installation

The thickness of DriTherm Cavity and the cavity width should be designed within the tolerances given in Table 2 (right). It is not possible to compress DriTherm Cavity during installation because its resilience will be enough to dislodge bricks before the mortar has set.

DriTherm Cavity Sshould be kept clean and free from mortar droppings. All joints should be closely butted. Any cutting and fitting should be neatly done and not distort the layers of glass/ rock mineral wool which comprise the material – see 'Problems to avoid' on opposite page. Cavity trays and damp proof courses (dpc`s) should be installed to ensure that penetrating water is directed only to the outer leaf.

The illustrations above outline technique only, and do not imply that the outer leaf must be built first.

Construction practice will vary from site to site. Where design details differ from those illustrated please do not hesitate to contact Knauf Insulation for any clarification required.

Wall ties

DriTherm Cavity is supplied in 1200 x 455mm slabs for use between wall ties at 450mm vertical centres. Standard butterfly, stainless steel wire ties and vertical twist ties are suitable, as are all ties with a positive drip which will penetrate the top edge of the DriTherm Cavity halfway across its width. The use of any other type of tie should be referred to Knauf Insulation Technical Support Team Centre. Advice should also be sought from the wall tie manufacturer as to the maximum cavity width for which the use of a specific tie is approved.

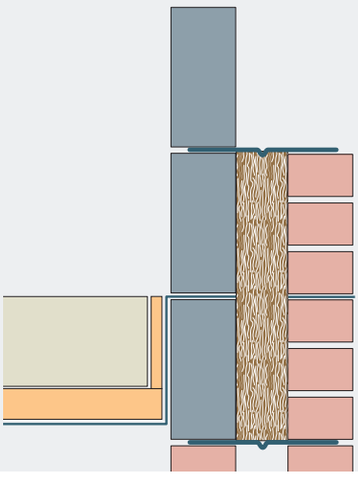
Generally, rows of wall ties should be at 450mm vertical spacing and at horizontal spacings of not more than 900mm or as otherwise required by the structure. Where whole rows of ties are at different vertical spacing, DriTherm Cavity should be cut to course, allowing an extra 5mm for compression to form close butt joints. Where extra ties are required, e.g. at the side of openings, DriTherm Cavity should be cut and fitted carefully around them. When off-cuts of DriTherm Cavity are needed, they can be cut with a long bladed knife or bricklayer's trowel.

Further recommendations

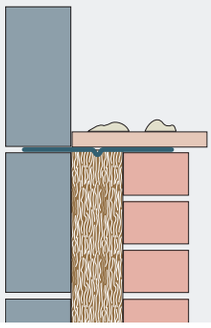
Above, below and beside openings, where cut strips of DriTherm Cavity may be needed, particular care should be taken to fit closely and ensure work is clean and free from debris. At the end of the day's work and during rainy periods, any exposed DriTherm Cavity should be covered.

If DriTherm Cavity is terminated vertically at an open cavity, a vertical dpc must be fitted up the inside face of the outer leaf to ensure that any mortar droppings on exposed edges do not bridge the cavity.

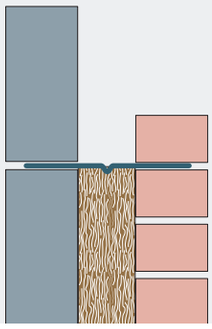
3 The following leaf is then built to the top level of the DriTherm Cavity. Do not let the second leaf overtake the DriTherm Cavity so as to create a trough (but see 5 regarding choice of leading leaf).



4 Proceed similarly with successive stages of the wall. As with normal masonry cavity construction, no mortar should remain in the cavity. Particular care should be taken to keep slab joints closely butted and free from mortar. To facilitate keeping the top edges of slabs clean it is recommended that a cavity board be used.



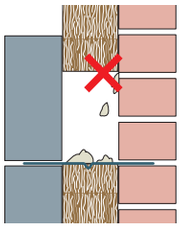
5 Building may proceed leading with either the inner or the outer leaf. When leading with the inner leaf it is recommended to build a trough not more than one brick deep at horizontal joints in DriTherm Cavity. The mortar joint should be struck flush inside the cavity and any mortar droppings must be cleaned off before the next DriTherm Cavity is fitted.



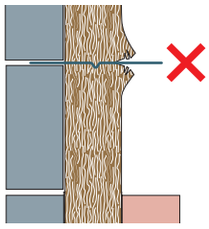
Permitted deviations in cavity widths

DriTherm Cavity size and nominal cavity width	Permitted cavity deviation
Thickness (mm)	(mm)
100	-0 or +15

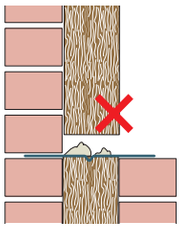
Problems to avoid



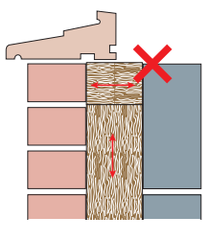
Do not push into the cavity. Mortar snots may be dislodged and bridge the cavity. This can happen all too easily where a change in the leading leaf occurs and care should be exercised at such positions to ensure correct application.



Do not tear or impale DriTherm Cavity. If there are protrusions into the cavity, DriTherm Cavity should be carefully cut to fit, particularly where there are extra wall ties around openings.



Do not position DriTherm Cavity on others which have not been cleaned of mortar droppings.



When using small off-cuts, the face of the product and not the edge, shall be positioned against the wall surface.

MASONRY CAVITY WALLS
FULL-FILL WITH BUILT IN GLASS MINERAL WOOL, EXTRA WIDE CAVITIES

Wider cavities

With the move towards carbon zero buildings, the use of wider cavities in masonry cavity walls is likely to become much more common.

DriTherm Cavity can be installed in multiple layers to fully fill cavities up to 300mm wide. Proprietary cavity closers and folded steel lintels are widely available for cavities up to 100mm wide. For cavities over 100mm wide, the choice of proprietary products is more limited. For cavities over 150mm wide, the detailing of openings may need to be altered radically.

Jambs

Cavities over 150mm wide present particular problems at the jambs. One solution to this is to use a plywood liner to the opening that can also double up as a former for the window frame. The diagrams below indicate this option for a 200mm wide cavity.

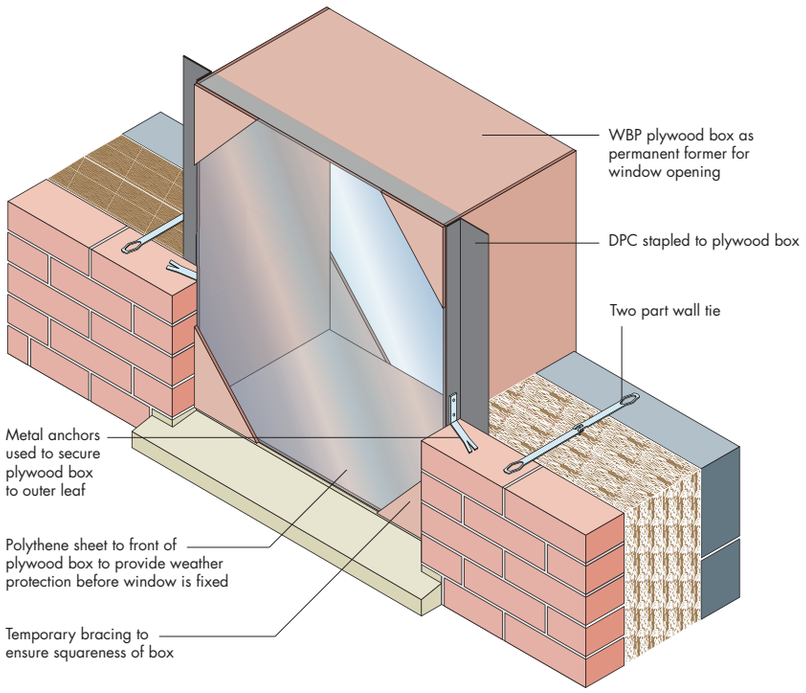
The plywood box solves a number of problems:

- It closes off the cavity
- It can be sealed against the inner and outer leaf to limit air leakage
- It provides an accurate template for the window frame
- The temporary polythene front cover provides weather protection until the window frame is installed
- The window frames can be installed after the brickwork is complete – reducing the risk of damage from mortar, etc.

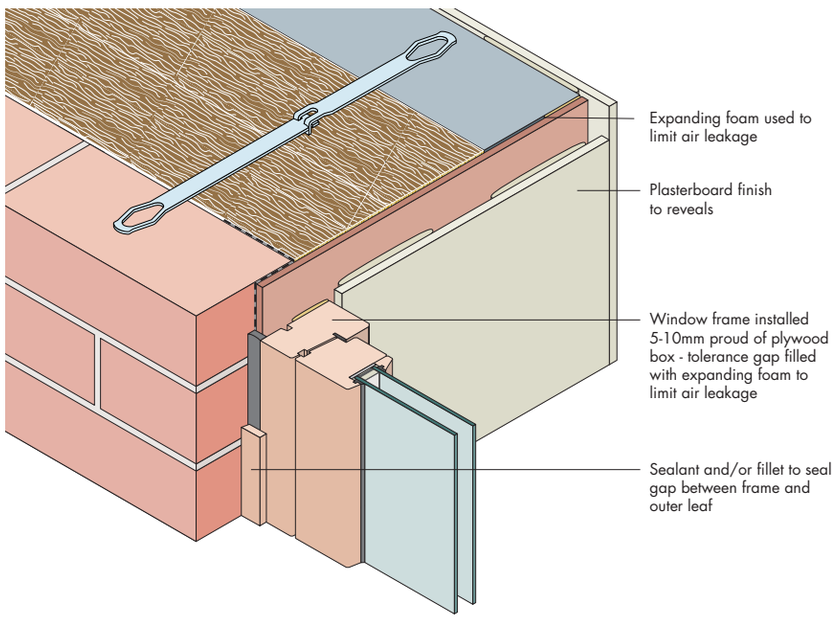
Lintels

The use of separate lintels for the inner and outer leaf becomes more common and practical as the cavity width increases. Separate lintels not only avoid the thermal bridging problems of one piece steel lintels, but they also

Typical use of a plywood box as former for window opening



Eaves detail showing installation of window frame in ply box



provide the designer with a greater level of design freedom. A concrete or aircrete lintel for the inner leaf is a simple, economic and firesafe option.

The lintel in the outer leaf can be anything from reconstituted stone to plain brickwork supported on a steel angle.

Wall ties

DriTherm Cavity is supplied 1200 x 455mm for use between wall ties at 450mm vertical centres. For cavities up to 175mm wide, stainless steel wire ties are recommended by Knauf Insulation because:

- Stainless steel has a thermal conductivity of 17 W/mK, compared with 50 W/mK for mild steel
- Wire ties have a much smaller cross-sectional area than flat metal ties

For these two reasons, stainless steel wire ties present a smaller thermal bridge through the cavity insulation than other types of metal wall tie.

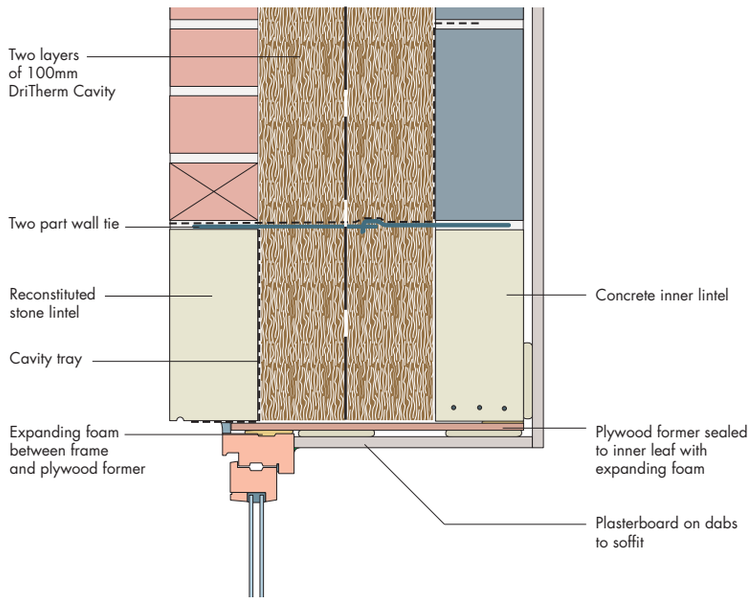
For cavities up to 175mm wide, double triangle stainless steel wire ties are available up to 300mm long.

These ties conform to BS EN 845 -1 : 2003 as a Type 3 tie. It is recommended that they are embedded 85mm into the inner leaf to help keep the cantilevered section of the tie horizontal during the build.

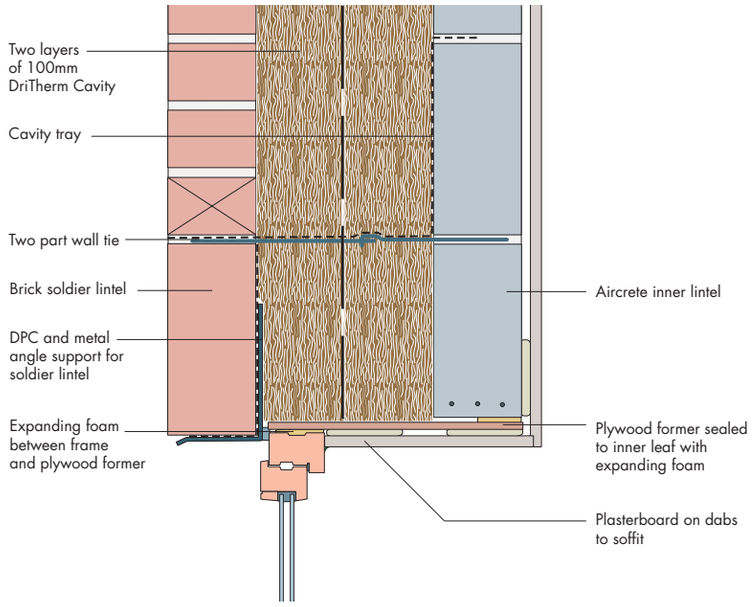
With the use of wider cavities, it is anticipated that other designs of stainless steel wire ties will be developed for cavities up to 175mm wide.

For cavities over 175mm wide, Knauf Insulation recommend the use of two part stainless steel ties. These ties overcome the problem of keeping a long tie horizontal when built into the inner leaf. However, they have a much greater cross-sectional area than wire ties and their thermal bridging effect must be taken into account when calculating the wall U-value. They are suitable for cavities up to 300mm wide.

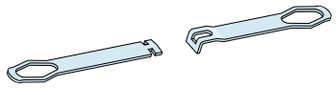
Typical detail using separate lintels



Typical detail using separate lintels and rebated window frame



The Ancon two-part wall tie



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KNAUF INSULATION

KNAUF INSULATION

LIGHT STEEL FRAME WALLS
SOLUTION OPTIMISER AND PATHFINDER

Overview

Light steel framing is extensively used due to its good thermal and structural behaviour. Heat loss reduction and thermal comfort have been the main driving forces defining the design of these frames. With this form of construction it is important that some insulation is placed inside or outside the steel frame to provide a thermal break and avoid condensation.

There are two major construction types:

Warm frame construction where all the insulation is outside the steel frame. One disadvantage of this technique is the loss of any possible insulation benefit by not utilising the space between the steel frame studs.

Hybrid construction, where insulation is included both inside or outside the steel structure and in between the steel components (a minimum of 33% of the thermal resistance should be provided outside the steel frame.) With this form of construction a condensation risk analysis (in accordance with BS 5250) should be provided by the system manufacturer to ensure there is no risk of interstitial condensation. A vapour control layer should be installed on the warm side of the internal insulation layer. This method is becoming increasingly popular both in standard 2-3 storey housing and high rise apartments alike.

Steel frame construction has many of the attributes of timber frame construction:

- Off-site prefabrication delivers a quality engineered product
- Quick erection of the structural frame and early creation of a dry envelope, thus removing the external finish from the critical path and enabling an early start on the internal fit out
- Wet weather does not interrupt erection process
- Lightweight structure reduces load on foundations, especially important on brownfield sites and rooftop extensions

In addition, steel has a higher strength to weight ratio than timber, enabling more flexibility in design and clear floor spans over 7m.

Light steel framed structures can be used for buildings up to six storeys high. A steel frame system is usually based on factory made or site assembled panels and sub-assemblies forming the structural steel framework of a building or the light steel infill system within a structural concrete or steel framed building.

Structural steel framed external walls are usually manufactured from 50mm or 150mm wide loadbearing C studs. The use of factory manufactured components guarantees dimensional accuracy and all structural steelwork should be fabricated from galvanised steel to BS EN 10326 : 2009 with a Z 275 coating.

Risk of condensation

With light steel frame constructions a vapour control layer is essential on the warm side of the insulation to reduce the risk of interstitial condensation forming. Where a foil faced insulation board is used on the outside of the steel frame, it is particularly important to ensure that the vapour control layer is continuous and not punctured by services.

Fire

A number of precautions are necessary with light steel frame construction:

- Cavity barriers and fire stopping must be provided at junctions with other elements in accordance with the requirements of UAE Civil Defence Regulations

The internal lining usually consists of two layers of plasterboard to provide 1 hour fire resistance to the loadbearing steel frame

- Insulation used on the cold side of the steel frame should be non-combustible, or have a class1 surface spread of flame where it faces a cavity

External loadbearing steel framed walls typically comprise:

- Internal lining of 12.5 mm thick, 12.5 mm thick, fire and moisture resistant plasterboard clad with 12.5 mm thick plasterboard
- Wall panels formed from channels (top and bottom) and C-section studs with diagonal cross bracing and lintels as required by the design
- Mineral wool friction fitted between the studs
- Insulation on the outside of the frame to prevent thermal bridging through the steel framework
- An external cladding – this can be anything from a rainscreen cladding system to a traditional brick outer skin

Other considerations

In accordance with BS 7671: 2008, the metal frame of the system must be provided with main equipotential bonding, using the relevant cable sizes.

The close tolerance of the steel frame means that the foundations should be constructed to provide a tolerance of ±5 mm over 5 metres. Galvanised steel shims must be added under each stud location to ensure that the gap between the bottom of the track and the foundation does not exceed these tolerances.

Consult the system manufacturer to confirm system specific details.

LIGHT STEEL FRAME WALLS
GLASS MINERAL WOOL BETWEEN STUDS

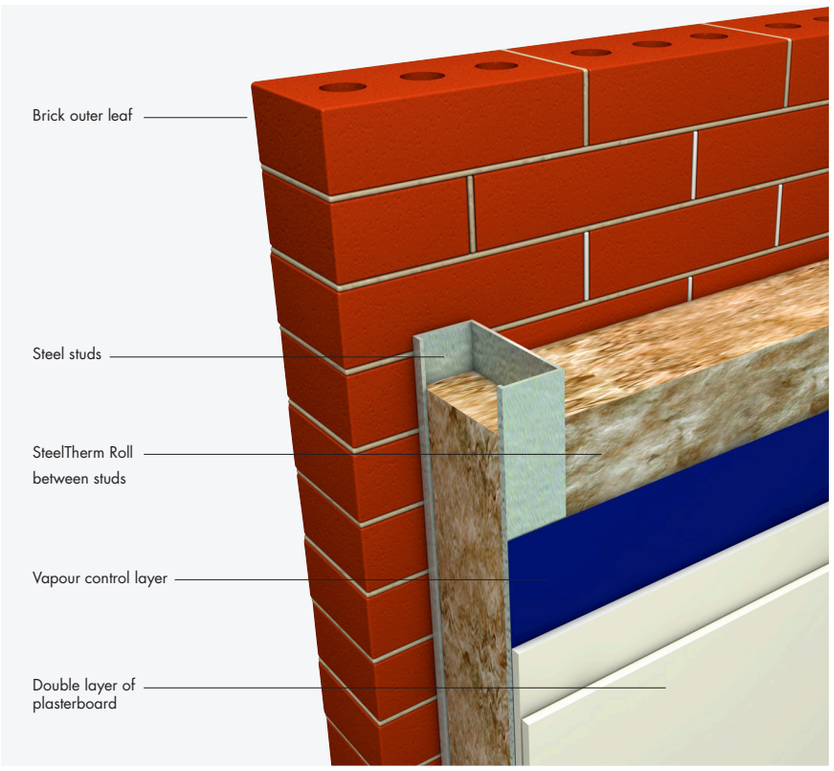
NEW BUILD

SteelTherm Roll

- **Manufactured size friction fits between common steel stud centres without any cutting on site**
- **Friction fitting between steel studs closes joints, preventing air movement and infiltration through or around the insulation**

SteelTherm Roll

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



LIGHT STEEL FRAME

Products

SteelTherm Roll is a lightweight, flexible glass mineral wool roll.

Typical construction

Inner leaf comprising a double layer of standard plasterboard, vapour control layer, SteelTherm Roll between steel stud.

A range of claddings can be applied, including an outer brick skin or terracotta rainscreen cladding.

Installation

Knauf Insulation products are dimensioned to suit standard steel studs at 600mm centres.

SteelTherm Rolls are friction fitted between the steel studs at standard centres and are self supporting.

A vapour control layer is taped to the studs across the inner face of the wall before fixing the plasterboard. The vapour control layer should be free from holes, any gaps should be made good, with tears repaired and overlaps and apertures for services effectively sealed. Particular care is necessary around electrical boxes.

Cavity barriers will have to be installed between the frame and the brickwork at suitable intervals to the full depth of the cavity.

Performance

Thermal performance

SteelTherm Roll 35 Ultimate has a thermal conductivity of 0.035 W/mK.

SteelTherm Roll 39 Super has a thermal conductivity of 0.039 W/mK.

SteelTherm Roll 41 has a thermal conductivity of 0.041 W/mK.

Fire performance

Unfaced SteelTherm insulation is A1 non-combustible.

SteelTherm is tested and listed UL 723, ASTM E84

Classification (UL723)	Unfaced	FSK
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

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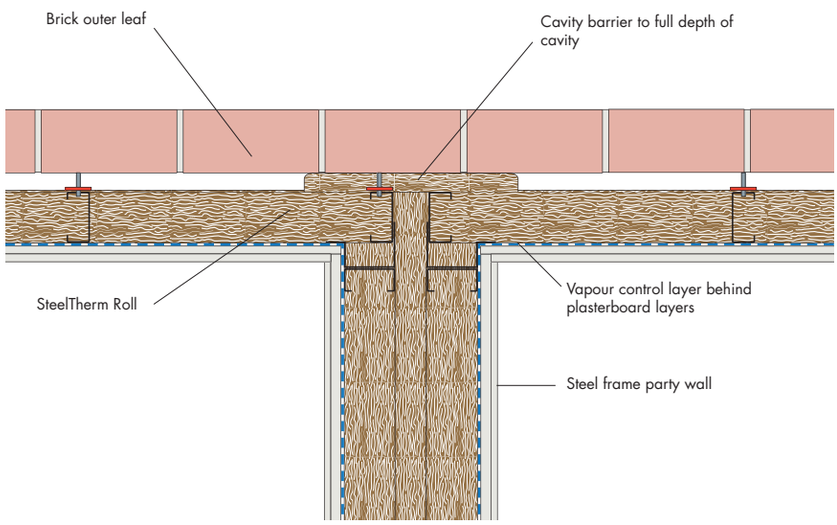
KNAUF INSULATION

LIGHT STEEL FRAME WALLS

Typical junction of external wall with party wall



Typical specification

External wall to be insulated between studs using SteelTherm Roll 41*/39*/35*.....mm thick . Insulation to be cut as necessary and friction fitted between studs.
(*Delete as appropriate).
Adjacent boards must be tightly butted to minimise heat loss. Trim boards to fit around window and door openings.

Cavity barriers and fire stops should be installed as required to meet the UAE Civil Defense Regulations.

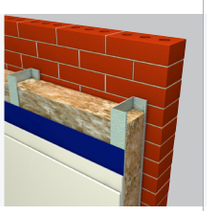
Typical U-values for steel framed wall with SteelTherm Roll between the studs		
Product	Thickness (mm)	U Value W/m²K
SteelTherm 41	100	0.41
	50	0.82
SteelTherm 39 Super	100	0.39
	75	0.52
	50	0.78
SteelTherm 35 Ultimate	100	0.35
	75	0.47
	50	0.70

Notes: The U-values have been calculated to BRE Digest 465. Steel stud bridge fraction is 0.00280, flange width is 50 mm. Stud depth is taken to be the same as the thickness of insulation specified. PIR lambda value is 0.023W/mK. Low emissivity air space resistance is 0.44m2K/W.

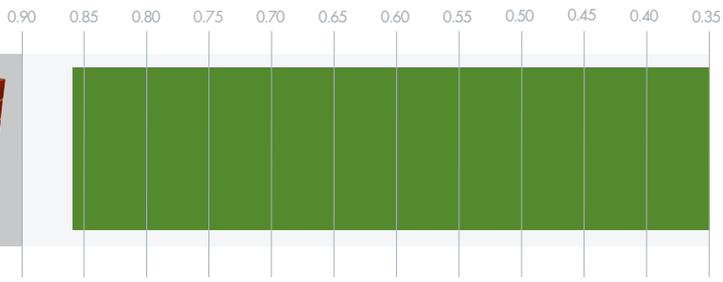
Solution optimiser and pathfinder

Knauf Insulation solution

Glass mineral wool between studs
Product: SteelTherm Roll



U-values



Key

Thermal insulation achievable by constructions within this document.

CLADDED WALLS
RAINSCREEN CLADDING AND CURTAIN WALL SYSTEMS

Rainscreen cladding systems

There are a wide variety of proprietary rainscreen cladding systems available most of which have the insulation installed on the external face of a masonry wall, this helps to keep internal temparatures stable by storing heat in the winter and reducing solar gains in the summer. Rainscreen cladding systems are also lightweight when compared to brick and masonry solutions and they can provide the designer with a wide range of aesthetic options.

Curtain wall systems

Curtain walls usually consist of a proprietary non structural lightweight frame which in some cases is designed to incorporate glass panels which act as the weatherproof facade and also allow daylight to penetrate into the building. There are several other types of curtain walling including factory built unitized systems which are typically comprised of insulation behind a glass, natural stone or metal facing.

Whenever a proprietary rainscreen cladding or curtain wall system is used, the system manufacturer's recommendation should be followed.

Weather protection

Rainscreen cladding systems are designed to keep both the structural frame and the thermal insulation dry, due to the rainscreen cladding itself but also due to the airspace between the cladding and the insulation.

Drained and ventilated rainscreen systems work by allowing air to enter at the base of the system and escape at the top of the system, the ventilated cavity allows water penetrating the panel joints to be partly removed by the 'stack effect' and partly removed by running down the rear face of the panels and out of the base of the system.

Curtain walls usually consist of a glass facade which is both waterproof and thus weather resistant.

Fire

For external wall constructions that include cavities (such as rainscreen cladding), cavity fire barriers are recommended at the junctions between the wall and every compartment floor or wall or other wall or door assembly that forms a fire-resisting barrier as detailed in UAE Civil Defense Regulations.

Fire barriers

The cavity barrier needs to be as per the system performance requirement and ensure compartmentation is established between the façade skin and the primary substrate. The barrier should be installed as per UAE Civil Defense Regulations.

KNAUF INSULATION

CLADDED WALLS
BEHIND RAINSCREEN CLADDING SYSTEM

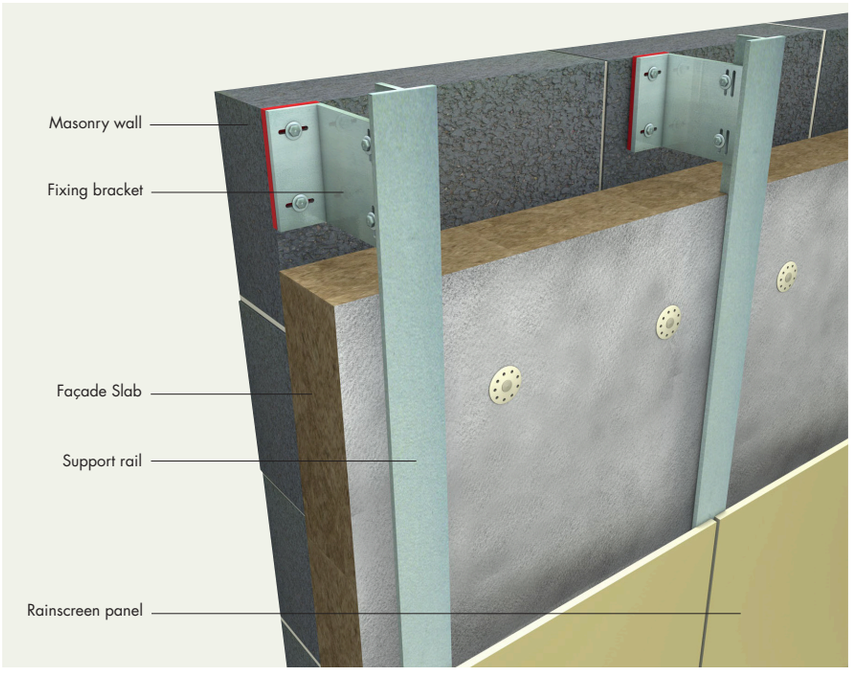
NEW BUILD REFURB

Façade Slab

- **Friction fitting behind and between cladding rails prevents air movement and infiltration through or around the insulation**
- **Lightweight, flexible slab is quick to install and also accommodates imperfections in substrate**

Façade Slab

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Product

Façade Slab is a glass mineral wool slab containing a water repellent additive, specially developed for rainscreen cladding applications. Its manufacture has a very low impact on the environment.

Typical construction

Rainscreen cladding systems comprise outer cladding panels that are bolted to a supporting framework of rails, which are supported by brackets fixed through a thermal break pad back to the building frame.

A layer of insulation is fixed independently against the building substructure using proprietary insulation fasteners.

Façade Slab is recommended for this application, as it is lightweight but rigid enough to resist the compression forces generated when installing the insulation slabs on the masonry substrate.

Installation

Façade Slab is positioned between the support brackets for the rainscreen cladding system and across the whole area to be insulated. Cut the slabs with a sharp knife to fit around the brackets so there are no gaps in the insulation. To minimise thermal bridging, the brackets should be of sufficient depth to allow the panel support rails to be located clear of the face of the insulation.

The insulation should be close butted and fixed independently against the building substructure using proprietary insulation fasteners in accordance with the design specification.

Once the insulation is firmly in place, the application of the cladding can proceed. Ensure that a ventilated cavity remains between the insulation and the external cladding. The dimensions of the ventilated cavity should not exceed the limits in the Building Regulations.

Performance

Thermal performance

Façade Slab 35 has a thermal conductivity of 0.035 W/mK.

Façade Slab 33 Super has a thermal conductivity of 0.033 W/mK.

Façade Slab 32 Ultimate has a thermal conductivity of 0.032 W/mK.

The U-value of a proprietary rainscreen cladding system is dependent on the degree of thermal bridging in the system. Typically 50mm of Façade Slab will achieve a U-value of 0.57 W/m^2K or better, but Knauf Insulation advise consulting proprietary rainscreen cladding manufacturers for U-values appropriate for their system.

Fire performance

FS Faced Façade Slab insulation is A2 non-combustible.

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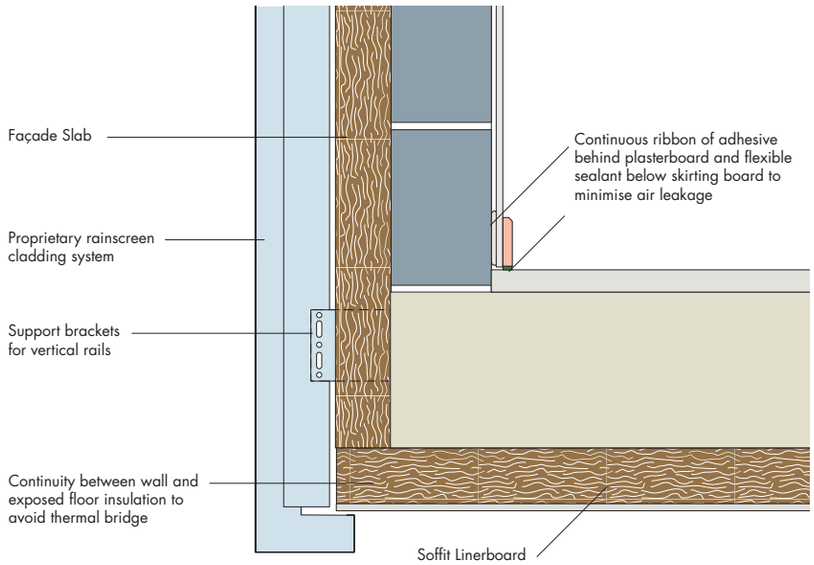
Typical junction detail with exposed floor



Typical specification

Façade Slab 35*/33*/32* .....mm thick to be fixed independently against the building substructure using proprietary insulation fasteners in accordance with the design specification. (*Delete as appropriate).

The insulation should be close butted and fitted around all adjacent parts of the rainscreen support brackets to minimise thermal bridging. Once the insulation is firmly in place the application of the rainscreen cladding can proceed.

U-values (W/m2K) Outer ACP-MCM /Airspace/Insulation/150mm block inner leaf, plasterboard

Insulation thickness (mm)	Product	Masonry Hollow Normal Weight Block (λ=1.13)	Masonry Solid Normal Weight Block (λ=1.69)	Lightweight Autoclave Aerated Concrete (AAC) Block (λ= 0.13)	High strength Autoclave Aerated Concrete (AAC) Block (λ=0.16)
50	Façade Slab 35	0.56	0.57	0.36	0.39
	Façade Slab 33 Super	0.53	0.55	0.35	0.37
	Façade Slab 32 Ultimate	0.52	0.53	0.34	0.37

Note: Fixings assumed to be plastic insulation holders with 5mm dia. steel expansion pin. The U-values have been calculated to BS EN ISO 10211 and BR 443. For project specific calculations contact our Technical Support Team Centre on +971 2 551 2453.

U-value calculations and rainscreen cladding systems

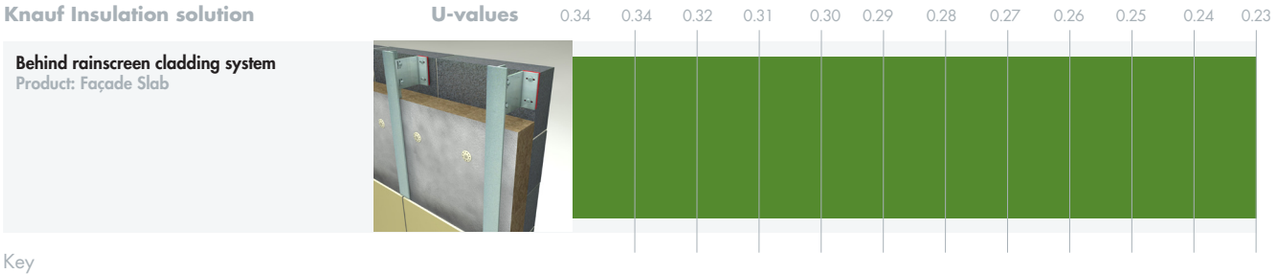
Rainscreen cladding systems can be very complex constructions due to the fact that they are made up of a variety of steel or aluminium components which are fastened together by various means.

It therefore, is no surprise that the heat flow paths through rainscreen cladding systems are also complex and cannot be accurately quantified by the normal calculation methods used to establish the U-value of a construction element.

Therefore, if the U-value for a rainscreen cladding system is calculated without employing numerical modelling, the U-value should be calculated without taking the rainscreen brackets consideration and then increased by 0.30W/m2K.

Our Technical Support Team Centre can supply numerically modelled U-value calculations for rainscreen systems installed on existing walls, new build walls or walls incorporating light steel frame systems, providing all relevant construction information is made available to us.

Solution optimiser and pathfinder



Key

Thermal insulation achievable by constructions within this document.

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KNAUF INSULATION

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 Support Team 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.

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.

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 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 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 mineral wool) to control sound reverberation which would otherwise be problematic.

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 mineral wool insulation.

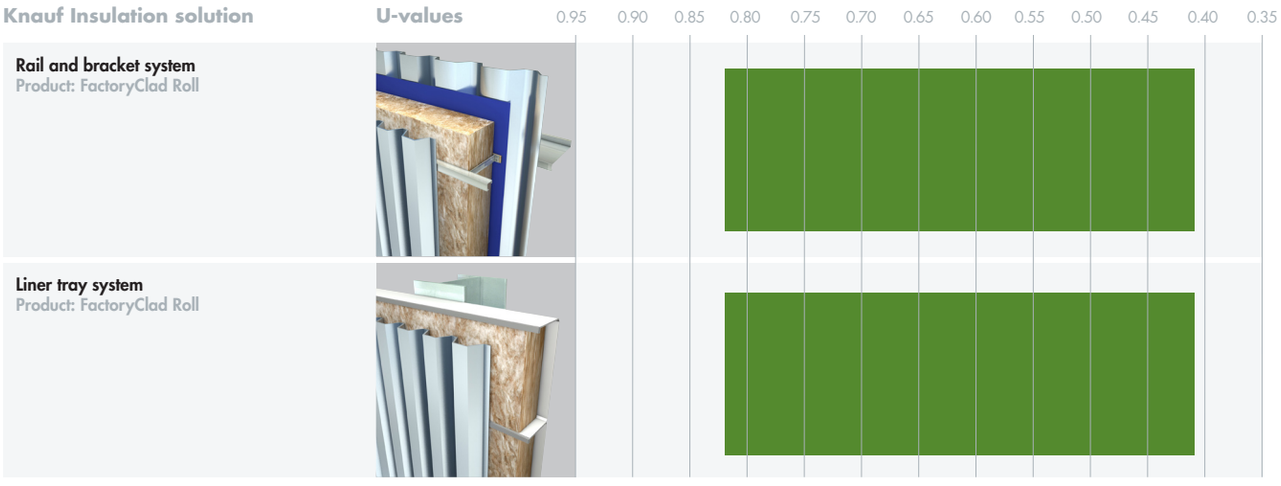
Control of condensation

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



KNAUFINSULATION

BUILT-UP METAL WALLS
RAIL AND BRACKET SYSTEM

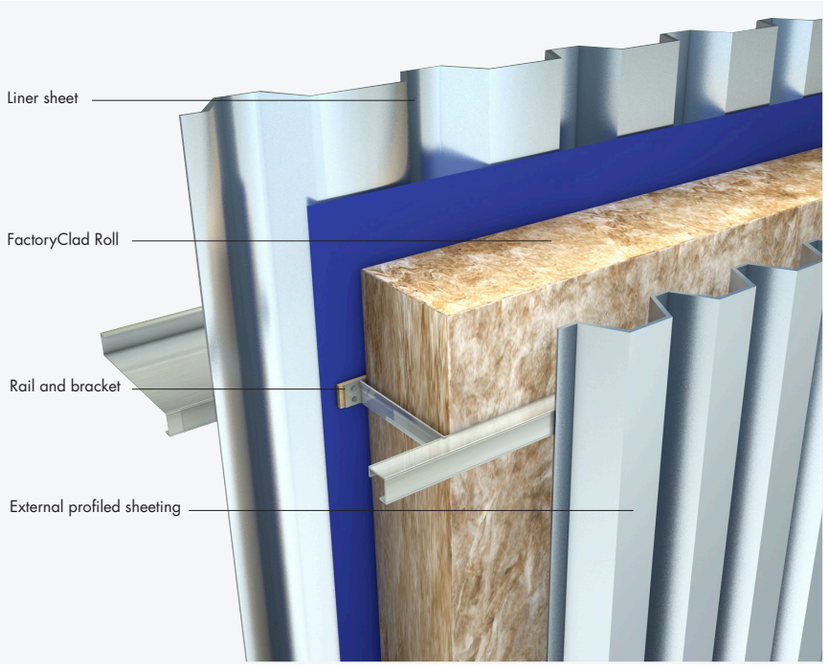
NEW BUILD REFURB

FactoryClad

- **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**

FactoryClad Roll

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

FactoryClad 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 FactoryClad installed between the external metal profiled sheet and the inner liner sheet.

FactoryClad is used for the thermal and acoustic insulation in profiled metal clad roofing 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.

FactoryClad 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 FactoryClad, to avoid exposure to the weather.

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Performance

Thermal performance

FactoryClad 41 has a thermal conductivity of 0.041 W/mK

FactoryClad 39 Wall has a thermal conductivity of 0.039 W/mK

Fire

FactoryClad Roll is tested and listed UL 723, ASTM E84

Classification (UL723)	FSK	WMP-10
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

Vapour resistivity

FactoryClad insulation with WMP-10 facing has a vapour transmission of 0 perms

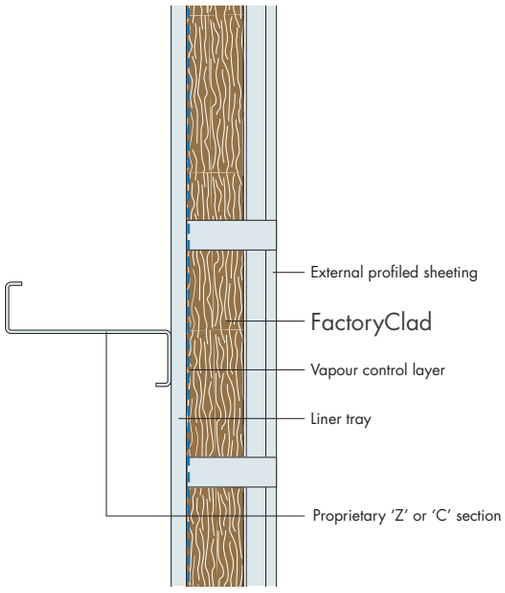
FactoryClad insulation with FSK facing has a vapour transmission of 0.02 perms

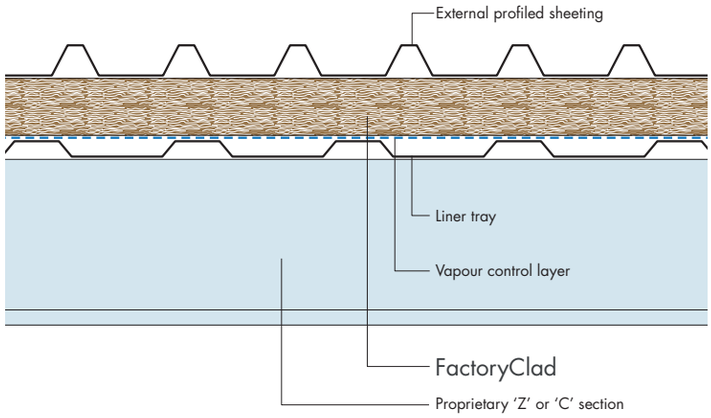
Acoustic performance

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.

Typical sections





Product	Rails at 1.20 metre spacings	
	Thickness (mm)	U-value (W/m²K)
FactoryClad 41	100	0.41
	50	0.82
FactoryClad 39 Wall	100	0.44
	50	0.78

Typical specification

FactoryClad 41*/39 Wall* ……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. (*Delete as appropriate).

NEW BUILD

FactoryClad Roll

- **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**

FactoryClad Roll

- Glass mineral wool is non-combustible
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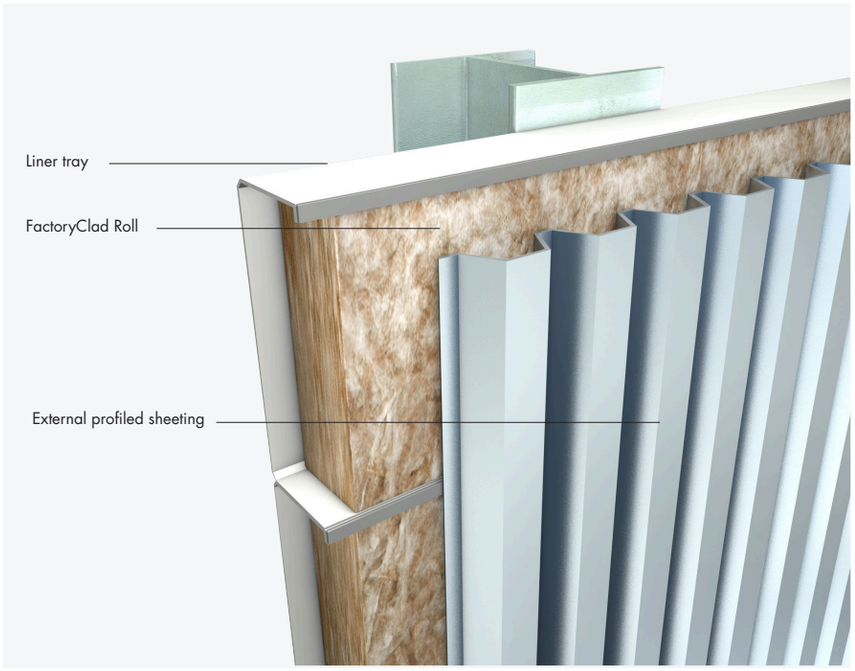


Products

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. 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. 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 FactoryClad Roll has been installed, to avoid exposure to the weather.

Performance

Fire performance
FactoryClad Roll is tested and listed UL 723, ASTM E84

Classification (UL723)	FSK	WMP-10
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

Thermal performance

FactoryClad Roll is produced in two different thermal conductivities as follows:

FactoryClad 41 has a thermal conductivity of 0.041 W/mK

FactoryClad 39 Wall has a thermal conductivity of 0.039 W/mK

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

Vapour resistivity

FactoryClad insulation with WMP-10 facing has a vapour transmission of 0 perms

FactoryClad insulation with FSK facing has a vapour transmission of 0.02 perms

Acoustic performance

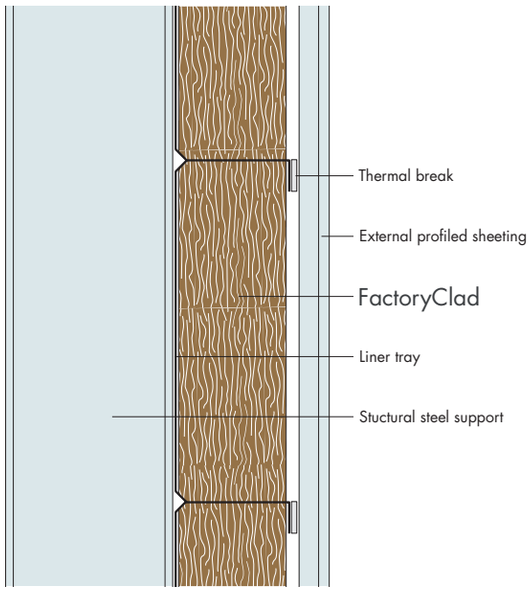
Sound absorption: Achieved by perforating the metal liner sheet and incorporating a 'soft' absorbing insulation material behind it. Different combinations of perforations and levels of insulation will give varying results of sound absorption.

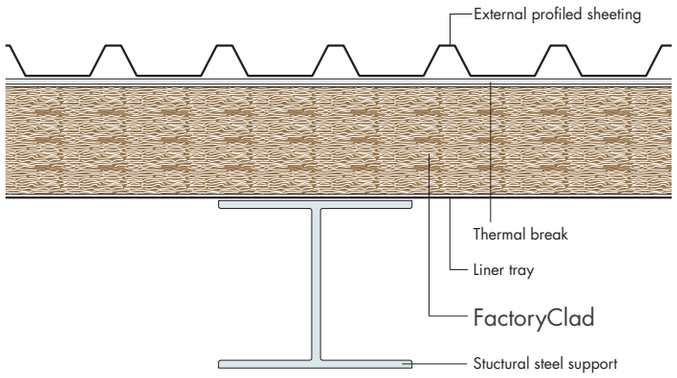
Airborne sound reduction: A standard insulated roof construction will have an approximate weighted sound reduction (Rw) of 33dB with an aluminium trapezoidal liner and 36dB with a steel trapezoidal liner. The acoustic performance can be increased by varying the number and the density of the insulation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

Environmental

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

Typical sections





Product	Rails at 1.20 metre spacings	
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FactoryClad 41	100	0.41
	50	0.82
FactoryClad 39 Wall	100	0.44
	50	0.78

Typical specification

FactoryClad 41*/39 Wall* ……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.(*Delete as appropriate).

Sound insulation

Sound Insulation, otherwise known as sound reduction, is the prevention of sound being transmitted from one part of a building to another, for example by erecting a partition or wall.

Improving the sound insulation of separating elements between dwellings is the main way in which the sound transmission between dwellings can be reduced.

When considering sound insulation of constructions various types of sound may need to be considered. The air tightness of the construction is also critical.

Airborne sound

Airborne sound sources produce noise by vibrating the air immediately around them.

Typical sources include the human voice, musical instruments, home entertainment systems and barking dogs.

The ability of an element of construction to resist the passage of airborne sound is largely determined by three factors:

1. The sound absorbency of any cavities in the construction
2. The structural isolation between the two outer surfaces
3. The mass of the element of construction

Increasing the mass of a separating element will improve its sound insulation but in timber and steel framed systems, the amount of extra weight that can be safely supported is often limited. As a result, other design approaches are usually employed i.e. structural isolation and the inclusion of products that absorb sound such as glass and rock mineral wool.

Impact sound

Impact sound is generated by direct physical excitation of part of a building. Examples include slamming doors, stamping on the floor and vibrating washing machines.

With impact sound, a relatively small impact can result in a loud sound being transmitted through the structure and over long distances.

Impact sound can be controlled by:

- Providing a resilient layer at the point of impact - such as a carpet
- Structural isolation - such as adding a resilient layer between the floor deck and the floor structure

Flanking sound

Flanking sound transmission usually refers to sound that travels through 'flanking' structural elements, such as the external wall that flanks a separating element between two dwellings.

Flanking sound can also include sound that travels along unintended airpaths, such as unsealed gaps in the structure and around service penetrations.

Flanking sound can be controlled by:

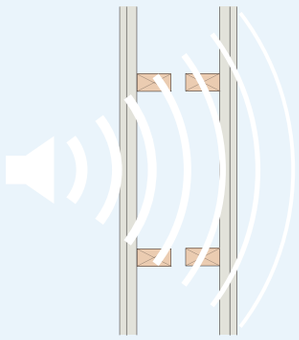
1. Sealing open airpaths
2. Forming a lining backed by a resilient layer to prevent sound energy entering the flanking element

Separating walls that meet the specifications in the Building Regulations can fail to meet the sound performance standard if the flanking junctions are poorly detailed. In order to meet the performance requirements when separating walls are tested, it is important to follow the guidance on the flanking details and not just the construction of the wall itself.

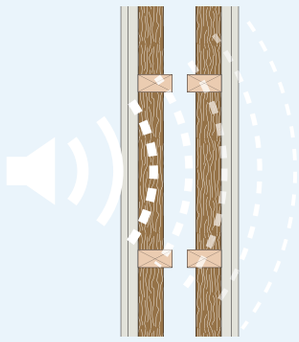
The rationale for using mineral wool as noise control

The sound absorption characteristics of mineral wool make it ideal for use in modern buildings to comply with Dubai Municipality Al Sa'fat 403.01 Acoustical Control Requirements, Estidama LBi-9: Indoor Noise Pollution requirements. In addition, the thermal properties of mineral wool provide a secondary benefit of minimising heat loss either between attached dwellings or between storeys within a dwelling. A further benefit is to minimise the overall mass of the construction, easing construction processes.

How glass mineral wool works in a wall or floor cavity



In an unfilled cavity, the plasterboard linings and cavity alone provide the sound insulation which can result in poor performance and a hollow sounding construction.



Adding mineral wool improves the sound insulation by absorbing reverberant sound within the cavity therefore reducing the amount of sound energy transferred from one side of the construction to the other.

Performance requirements

In UAE, the Dubai Municipality Al Sa'fat Green Building Rating System and Estidama Pearl Rating System sets out the requirement for the sound insulation of internal walls within houses and flats. The requirement is for all internal walls between a bedroom or room containing a WC and another room to have a minimum sound insulation of 40 Rw dB.

This applies to new walls built both in dwellings formed by a material change of use and new build extensions of existing dwellings.

Acoustic performance

In general performance requirements are set by client requirements, but in some purpose groups there are specific Al'Safat and Estidama requirements.

Schools

Al'Safat and Estidama refers to specific performance standards are set for airborne sound insulation between spaces by Building Bulletin 93 'The Acoustic Design of Schools'. This classifies each room for the purpose of airborne sound insulation by its activity purpose in terms of activity noise, as a source room, and noise tolerance, as a receiving room, and then sets the performance standard for sound insulation for each partition.

Hospitals

Similarly to schools the Healthcare Technical Manuals HTM 08-01 (previously HTM 2045) sets standards for privacy according to room type and from this the specific performance requirement for any partition can be obtained.

Fire performance

Generally fire performance of partitions will be determined in line with the appropriate Building Regulations if the purpose of the partition is to provide compartmentation. In certain buildings there may be specific fire performance requirements for partitions separating specific room types, for example in Hospitals where this is set by Civil Defence Code. The use of mineral wool helps to improve the fire rating of a partition by limiting the transfer of heat across the cavity.

Quality of detailing

A construction can only achieve its expected sound performance if it, and the surrounding walls and floors have no inherent faults in their detailing or workmanship. Acoustic performance will be impaired if there are:

- Gaps or holes in the construction – even hairline cracks can seriously impair sound insulation - seal all potential gaps with a flexible sealant
- Gaps in the absorbent layer within the cavity

Thermal insulation

Whilst thermal insulation is not generally a requirement of partitions, it may be desirable in certain circumstances. For example, insulated partitions around rooms with high internal heat gains would help to avoid overheating in adjoining rooms during hotter periods.

Performance standards for airborne sound insulation between spaces – minimum weighted BB 93 standardised level difference, DnT (Tmf,max),w (dB)

Minimum D_{nT} (Tmf, max), w (dB)		Activity noise in source room (see Table 1.1)			
		Low	Average	High	Very high
Noise tolerance in receiving room (see Table 1.1)	High	30		45	55
	Medium	35	40	50	55
	Low	40	45	55	55
	Very low	45	50	55	60

1 Each value in the table is the minimum required to comply with the Building Regulations. A value of 55 D_{nT} $(Tmf,max)_{,}$ w dB between two music practice rooms will not mean that the music will be inaudible between the rooms. In many cases, particularly if brass or percussion instruments are played, a higher value is desirable.

2. Where values greater than 55 D_{nT} $(Tmf,max),w$ dB are required it is advisable to separate the rooms using acoustically less sensitive areas such as corridors and storerooms. Where this is not possible, higher performance constructions are likely to be required and specialist advice should be sought. It is also important to ensure that high-use corridors are not themselves a significant source of noise.

3. It is recommended that music rooms should not be placed adjacent to design and technology spaces or art rooms.

4. These values of DnT $(Tmf,max),w$ include the effect of glazing, doors and other weaknesses in the partition. In general, normal (non-acoustic) doors provide much less sound insulation than the surrounding walls and reduce the overall D_{nT} $(Tmf,max),w$ of the wall considerably, particularly for values above 35 $D_{nT}(Tmf,max),w$ dB. Therefore, doors should not generally be installed in partitions between rooms requiring values above 35 D_{nT} $(Tmf,max),w$ dB unless acoustic doors, door lobbies, or double doors with an airspace are used. This is not normally a problem as rooms are usually accessed via corridors or circulation spaces so that there are at least two doors between noise-sensitive rooms.

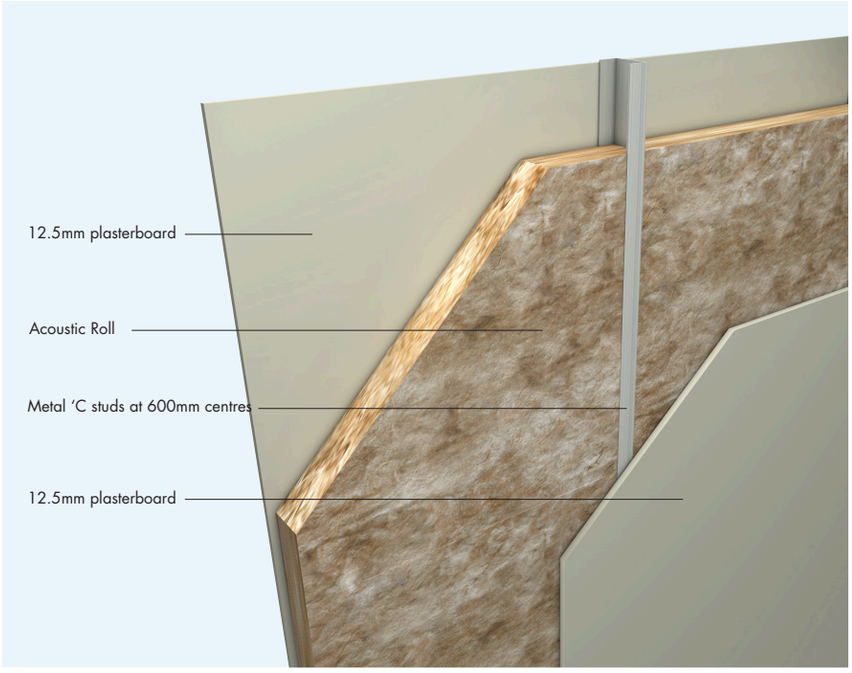
NEW BUILD REFURB

Acoustic Roll

- **Acoustic performance of at least 40 Rw dB**
- **Friction fitting between steel studs closes joints and helps to ensure sound insulation performance is achieved**
- **Provides a high degree of thermal insulation, enabling a greater degree of comfort control throughout the building**

Acoustic Roll

- Non-combustible with a Euroclass A1 reaction to fire rating
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Acoustic Roll is a flexible, resilient glass mineral wool roll.

Typical construction

A metal stud partition infilled with Acoustic Roll and faced each side with 12.5mm standard plasterboard meets the requirements of the Building Regulations for a 40 Rw dB partition. The partition should be sealed with an acoustic sealant at its perimeter and at all service penetrations.

Installation

Construct the steel frame and apply a bead of acoustic sealant to the back of the steel studs that are fixed to the surrounding structure. Board out one side of the partition before inserting the insulation.

Acoustic Rolls are designed to friction fit between metal studs at 600mm centres.

When installing 25mm of Acoustic Roll, support the roll at the head of the partition by means of a timber batten or light steel angle.

For maximum acoustic performance, hang the quilt in the centre of the partition void and fit snugly up against the studs on both sides.

50mm Acoustic Rolls are sufficiently rigid not to require supporting at the head of the partition.

Board out the second side and finish with a plaster skim coat or using standard drylining techniques.

Performance

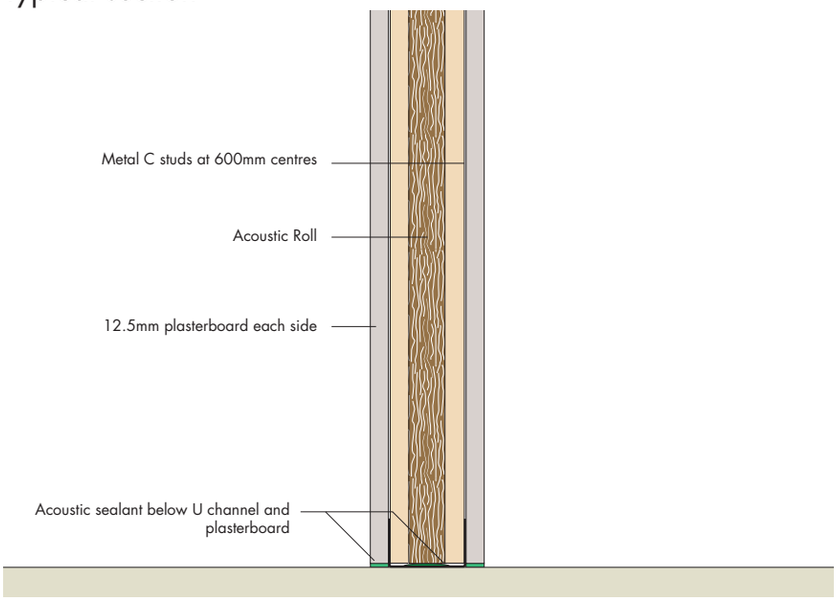
Fire performance

Acoustic Roll is classified as Euroclass A1 to BS EN 13501- 1.

Density

50mm Acoustic Roll has a density of 16 kg/m3.

Typical section



Typical specification

In all …… (metal stud) partitions install Acoustic Roll, ……mm thick. Secure 25mm Acoustic Roll at head of partition using timber batten or light steel angle. Insulation to fit snugly between studs and at bottom of the structure to ensure that there are no air gaps. Seal partition at perimeter and all service penetrations with an acoustic sealant.

Sound insulation performance of metal stud partition

Stud type	Stud spacing (mm)	Facing	Infill	Sound insulation (R_WdB)	Fire resistance (hours)
50mm C stud	600 c/s	12.5mm Knauf Drywall RG each side	50mm Acoustic Roll	38	0.5
70mm C stud	600 c/s	15mm Knauf Drywall RG each side	50mm Acoustic Roll	44	0.5
70mm C stud	600 c/s	2 layers of 12.5mm Knauf Drywall FR Boards each side	50mm Acoustic Roll	52	1.5
70mm C stud	600 c/s	2 layers of 15mm Knauf Drywall FR Boards each side	50mm Acoustic Roll	53	2
2 X 50mm C stud	600 c/s	2 layers of 12.5mm Mada Gypsum FR Boards each side	100mm Acoustic Roll	55	2
2 X 50 mm C stud	600 c/s	2 layers of 12mm Knauf Drywall RG Boards each side	100mm Acoustic Roll	56	1
2 X 50 mm C stud	600 c/s	2 layers of 15mm Knauf Drywall FR Boards each side	100mm Acoustic Roll	58	2

Many clients perceive that rooms above exposed upper floors will be hot. However, it is possible to achieve very high levels of thermal insulation in exposed upper floors. The designer has a choice of where to position the insulation: for concrete floors, either above or below the floor.

If insulating below the structural floor, the insulation can be laminated to a variety of materials thus the floor can be insulated and finished in one process.

Insulating above the structural floor reduces the thermal mass of the floor allowing for fast warm up. However, if only part of the floor on that storey is exposed it may cause problems with steps between finished floor levels.

Shelter factors

Where an exposed floor is over an enclosed but un-conditioned space, such as a podium car parks, the shelter factor of the garage improves the U-value of the exposed floor. Conventions for U-value calculations, sets out the shelter factors to be applied to separating floors in these locations.

There are specific additional requirements that need to be taken into consideration when calculating the U-values for elements that are adjacent to un-conditioned spaces.
The U-value of an exposed floor (soffit) which separates a conditioned area from an un-conditioned area, can be calculated by including an additional amount of thermal resistance (Ru) due to the sheltering effect of the un-conditioned area.

Standard default values of Ru can be taken from Dubai Municipality Al Sa'fat Green Building Rating System and Estidama Pearl Rating System. For situations not covered by default values, or where additional guidance is required contact our Technical Support Team Centre on +971 2 551 2453.

Concrete upper floors

Insulation can be positioned above or below
the concrete floor. When above the floor, the insulation is usually located below a floating screed. If only part of a concrete slab is insulated, careful detailing may be needed to avoid steps in the floor level.

Insulation located below the floor should be covered, usually with plasterboard or other fire resistant boards.

Weather resistance

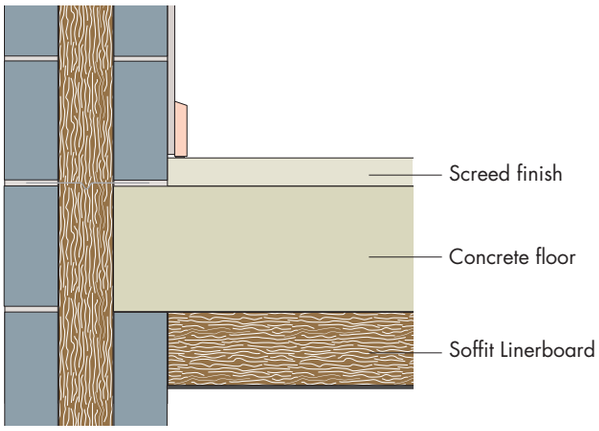
The soffits of exposed floors may need to be finished with a weather resistant finish. Although not exposed to direct driving rain, wind turbulence can result in wind-driven drain being blown up onto soffits. Another consideration is that soffits, being sheltered from the washing effect of wind driven rain, tend to collect dirt and grime over time.

Fire resistance

The fire resistance of the exposed floor should comply with UAE Civil Defense Regulation requirements. This will be between 1 to 4 hours, depending on the purpose of group of the building and its height above ground.

Positions for floor insulation

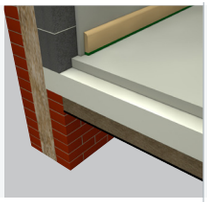
Insulation below concrete floor

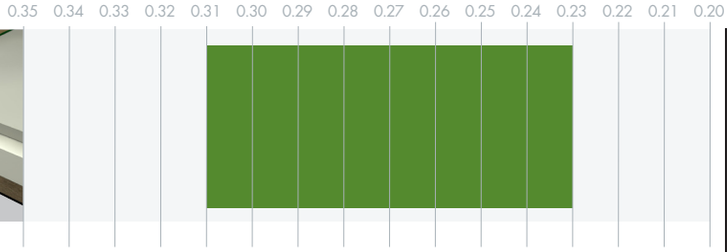


Solution optimiser and pathfinder

Key

Thermal insulation achievable by constructions within this document.

Knauf Insulation solution	U-values
Below concrete soffit **Product:** Soffit Linerboard	



EXPOSED SOFFIT

KNAUF INSULATION

EXPOSED SOFFIT
BELOW CONCRETE SOFFIT

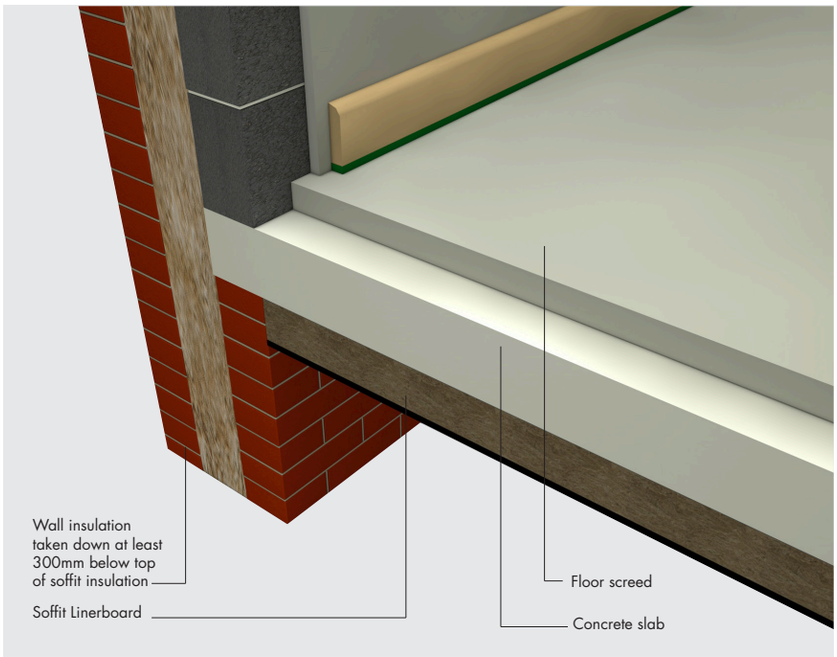
NEW BUILD REFURB

Soffit Linerboard

- **Installed without the need to access areas above the floor**
- **Provides a solution to upgrade thermal performance of existing floors without reducing floor height**

Soffit Linerboard

- Glass mineral wool is non-combustible
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)



Products

Soffit Linerboard is a non-combustible glass mineral wool slab with a black tissue facing.

Typical construction

A concrete upper floor slab or beam and block floor insulated on the underside with Soffit Linerboard. The linerboard can either be screw fixed directly to the slab, or to timber battens either fixed directly to the soffit or nailed to ceiling clips held within the joints of prestressed concrete units.

Installation

Fixing directly to soffit

Ensure the structure is stable and suitable to support the extra load of the lining boards. If in doubt, seek specialist advice.

Soffit Linerboard is screwed to the structure using suitable fixings, set in at least 50mm from any board edge. All boards to be butt jointed.

There are a wide range of fixings available from suppliers such as Rawlplug, Hilti, Ejot and Fisher. Typically 4 fixings per board are required for Soffit Linerboard. However, due to variations in the specification of concrete, Knauf Insulation advise you to seek specialist advice from the fixing manufacturer.

Where board edges are exposed, ensure insulation is covered with either a cement board or a suitable flashing.

Use a flexible and fire resistant sealant to seal any imperfection of fit at junctions between boards and walls.

Performance

Thermal performance

Soffit Linerboard has a thermal conductivity of 0.037 W/mK.

Fire performance

Soffit Liner is tested and listed UL 723, ASTM E84

Classification (UL723)	FSK	WMP-10
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

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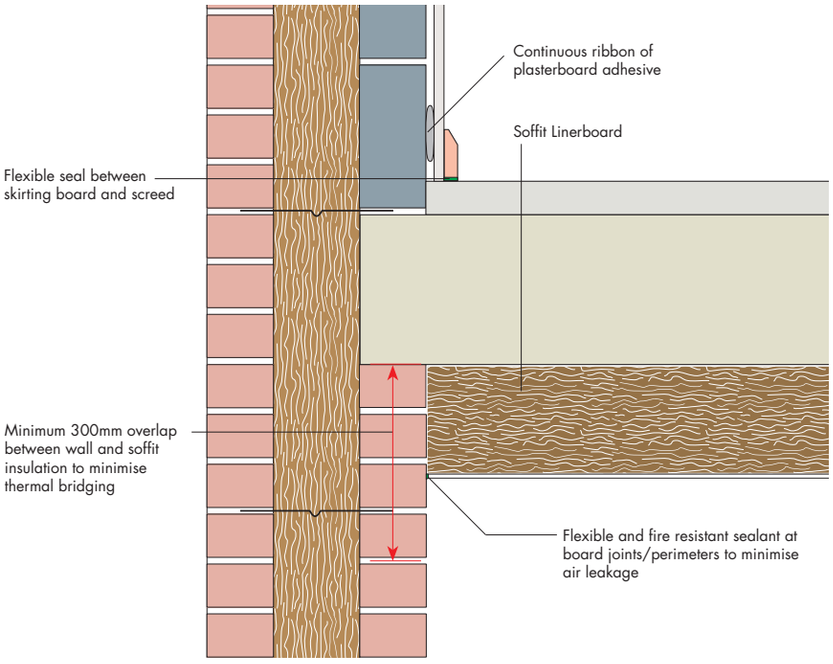
Typical wall/floor junction Soffit Linerboard



Typical specification

Soffit Linerboard thickness.....mm to be screwed to the structural soffit using ..... fixings manufactured by ..... Fixings to be set in at least 50mm from any board edge. Boards to be butt jointed.

Weight of Soffit Linerboard

Product	Thickness (mm)	Weight kg/ m^2
Soffit Linerboard	100	9.5

Typical U-values of upper concrete floor with 50mm screed finish

U-values (W/m^2K) 200 mm Slab/Insulation					
Insulation thickness (mm)	Product	Masonry Hollow Normal Weight Block (λ=1.13)	Masonry Solid Normal Weight Block (λ=1.69)	Lightweight Autoclave Aerated Concrete (AAC) Block (λ= 0.13)	High strength Autoclave Aerated Concrete (AAC) Block (λ=0.16)
100	Soffit Liner Board	0.31	0.32	0.22	0.23
	Soffit Liner Extra	0.31	0.31	0.22	0.23

Note: There are specific additional requirements that need to be taken into to consideration when calculating the U-values for elements that are adjacent to unheated spaces. The U-value of an exposed floor (soffit) which separates a heated area from an unheated area can be calculated by including an additional amount of thermal resistance (R_u) due to the sheltering effect of the unheated area. Standard default values of R_u can be taken from BR 443 (Conventions for U-value calculations) or SAP 2009. For situations not covered by default values, or where additional guidance is required contact our Technical Support Team Centre on +971 2 551 2453.

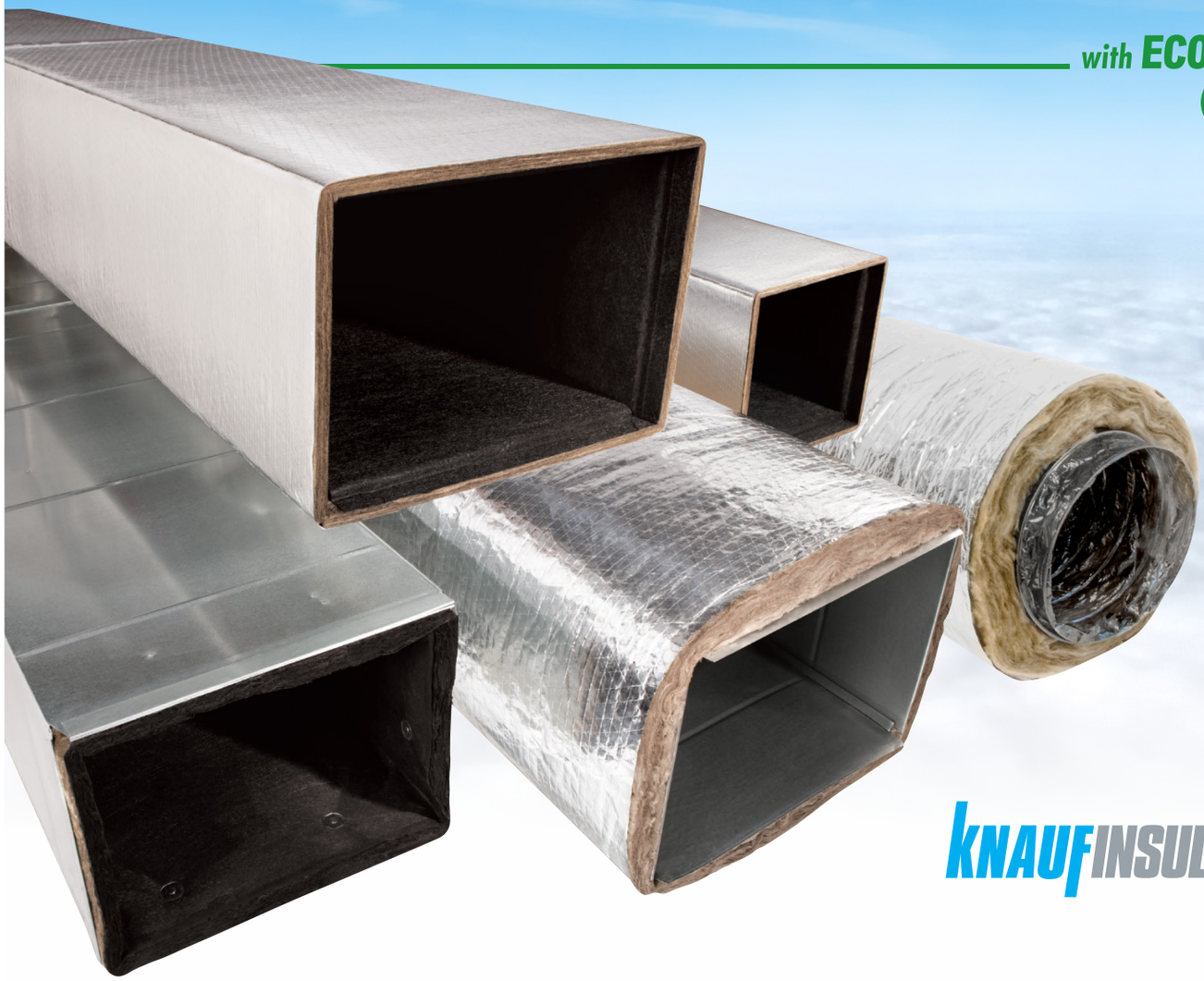
ATMOSPHERE

The new Atmosphere line from Knauf Insulation aims to offer a healthier series of air handling products for improved indoor air quality.

Using ECOSE technology, it is the only such insulation available that's free of both formaldehyde and Decabromodiphenyl other (decaBDE) and the only insulation to received the coveted Eurofins Indoor Air Quality Gold Standard.

Products in the Athmoshpere line are highly resistant to mold and meet the USA benchmark ULe Greenguard Gold Indoor Air Quality Standard.

with ECOSE® TECHNOLOGY



KNAUF INSULATION

HVAC

HVAC Duct Systems are designed to ensure both the thermal energy efficiency of buildings and the acoustic comfort of the occupants, whilst minimizing the risk of fire and smoke spread in a building. Installation design takes into account the air exchange rates in the building, the number of occupants and their activities, its interior characteristics and the materials from which it is constructed.

HVAC Duct systems require thermal insulation where the most efficient option and the option with maximum fire safety is glass mineral wool, usually in roll form wrapped around the outer duct wall. The Duct wrap incorporates an aluminum foil facing that acts as a vapour barrier.

Due to glass mineral wools exceptional sound-absorbing properties, insulation can also be installed on the inner wall of the duct where the insulation acts as an acoustic absorber, reducing duct transmitted noise such as crosstalk and sound energy from air movement and mechanical equipment.

Design Considerations

The designer will have to consider many factors when designing a HVAC ducting system and when considering the choice of insulation material including:

- Thermal Insulation
- Acoustic Performance
- Energy Efficiency
- Fire Safety
- Control of Condensation
- Environmental impact of the materials.

Thermal Insulation

HVAC metal duct systems require thermal insulation to reduce heat loss, avoid condensation and improve comfort. The most common materials for this application are glass wool rolls which are wrapped around the duct's outer surface.

A temperature controlled work environment is vital to employee health and productivity.; Insulation in walls, ceilings and ducts makes it possible to maintain not only an energy efficient building, but also a more comfortable environment for building occupants. The work environment requires consistent temperatures throughout the entire building with hot and cold spots minimized.

Glass mineral wool duct insulation products should be included to help a building's HVAC system deliver conditioned air at design temperatures without over-working the HVAC system. Besides potentially reducing the size of HVAC equipment, properly insulated ducts also contribute to reduced operating costs.

Control of condensation

Preventing unwanted moisture, especially in the HVAC system, is another important function of insulation in commercial construction. Glass mineral wool HVAC insulation helps prevent moisture from condensing on the inside or outside of ducts, and dripping onto ceiling tiles.

Knauf Insulation's glasswool products with factory applied Aluglass facing are an ideal substitute for conventional insulation barriers to deter moisture. With Aluglass's zero water vapour permeability credentials, water vapour cannot permeate through, and this eliminatesthe need for any additional application of vapour barriers.

Energy Efficiency

Insulating ducts and pipes will ensure energy efficiency is sustained, which in turn will save energy and lower operating costs.

Acoustic Insulation

HVAC installations generate different levels and spectra of sound, depending on the design, installation and equipment power source. Of primary concern in acoustic design is the transmission of noise produced by fans and air conditioning units via the ducts. Knauf utilize specifically designed interior insulation materials for sheet metal ducts to be used in HVAC applications which provide an optimum combination of efficient sound absorption with minimal airstream surface friction. Where installed, building occupants benefit from less unwanted noise and more consistent temperatures for improved comfort.

Spread of Fire

Incorrect or poorly designed duct networks may contribute to the spread of fire and smoke throughout a building, as they offer direct physical access by which the fire can travel. Unlike many alternative insulation options, due to its non-combustible nature, glass mineral wool will minimize the fire propagation and create a passive fire protection in case of a break out of fire.

In particular, smoke emitting from, burning plastics such as polyethylene and a range of PVC products also has an increased toxicity and threat to life. The vast majority of today's fires are likely to involve plastics, and apart from soot, the smoke will produce poisonous gases that will include carbon monoxide, hydrogen chloride, hydrogen oxide, sulphur dioxide, ammonia and chlorine amongst others, depending on the plastic that is burning.

Indoor Air Quality

Ducts are used in HVAC to deliver and remove air. Airflows include supply air, return air and exhaust air. Ducts commonly also deliver ventilation air as part of the air supply . As such, air ducts are one method of ensuring acceptable indoor air quality as well as thermal comfort.

ECOSE Technology is a revolutionary binder chemistry that makes Knauf Insulation products even more sustainable. It is based on rapidly renewable bio-based materials rather than non-renewable petroleum-based chemicals traditionally used in fiber glass insulation products. ECOSE Technology reduces binder embodied energy and does not contain phenol, added formaldehyde, acrylics or artificial colors.

With the ECOSE Technology, Knauf Insulation has become the world's first company to receive the coveted Eurofins Indoor Air Comfort Gold standard.

The Gold standard certificate was awarded to Knauf Insulation's revolutionary glass mineral wool products made with ECOSE Technology and provides a strong endorsement of the enhanced environmental performance of Knauf Insulation's new ECOSE Technology product range.

challenge. create. care.

KNAUF INSULATION

DUCT WRAP
EXTERIOR OF RECTANGULAR OR ROUND SHEET METAL DUCTS

Atmosphere Duct Wrap

- **Suitable for the exterior of rectangular or round sheet metal ducts and spaces or surfaces where temperature and condensation must be controlled.**
- **Provides a high degree of thermal insulation, enabling a greater degree of energy efficiency in the ducting system**
- **FSK facing has a water vapor permeance of .02 perms**
- **Aluglass facing has a maximum water vapor permeance of 0 perms, elminating the need for additional vapor barriers.**

- Eurofins Indoor Air Quality Gold Standard
- Flame Spread 25 and Smoke Developed 50 when tested in accordance with UL 723, ASTM E 84
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)

Products

Atmosphere™ Duct Wrap is a thermal and acoustic insulation blanket. Atmosphere Duct Wrap is used as external insulation on commercial or residential heating or air conditioning ducts. It is suitable for the exterior of rectangular or round sheet metal ducts and spaces or surfaces where temperature and condensation must be controlled.

Typical construction

Knauf Insulation Atmosphere Duct Wrap is used as external insulation on commercial or residential heating or air conditioning ducts. It is suitable for the exterior of rectangular or round sheet metal ducts and spaces or surfaces where temperature and condensation must be controlled.

Installation

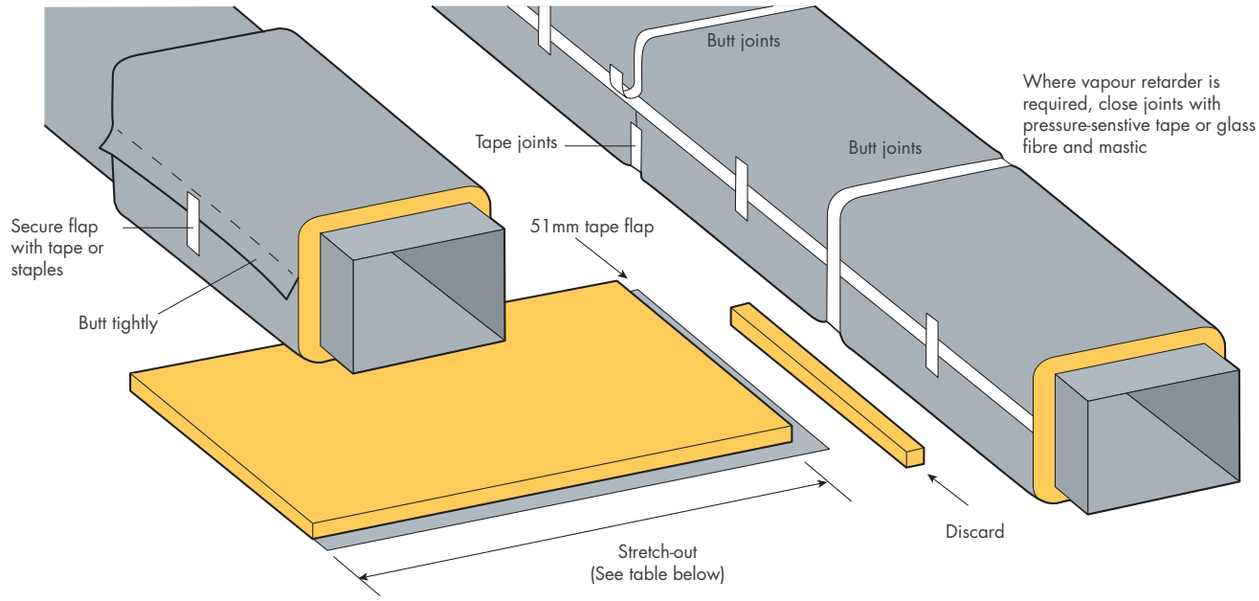
Preparation

Install Knauf Insulation Atmosphere Duct Wrap over clean, dry sheet metal ducts. All sheet metal joints and seams must be sealed to prevent air leakage from the duct.

Application

- Install Knauf Insulation Atmosphere Duct Wrap with facing to the outside to obtain specified R-value using a maximum of 25% compression
- Butt all insulation joints firmly together. Longitudinal seam of the vapor retarder must be overlapped a minimum of 50mm. A 50mm tab is provided for the circumferential seam and must be overlapped
- Where vapor retarder performance is necessary, all penetrations, joints, seams and damage to the facing should be sealed with an foil tape or glass fabric and mastic prior to system startup
- Pressure sensitive tapes should be a minimum 76 mm wide and be applied with moving pressure using an appropriate sealing tool
- Staples should be outward clinch and placed approximately 152 mm on center
- Closure systems should have a 25/50 F.H.C. per UL 723
- For rectangular ducts over 610 mm wide, secure the insulation to the bottom side of the duct with mechanical fasteners spaced on 457 mm centers to reduce sag. Care should be taken to avoid over compressing the insulation with the retaining washer
- It is neither necessary nor desiable to adhere duct wrap to duct surfaces with adhesive

Typical installation



Stretch outs				
Insulation thickness (mm)	Installed compressed thickness (mm)	Round (mm)	Square (mm)	Rectangular (mm)
38	29	P+241	P+203	P+178
51	38	P+305	P+254	P+203
56	42	P+330	P+279	P+216
64	48	P+368	P+318	P+241
76	57	P+432	P+368	P=292

P = Perimeter of duct to be installed

Installation Procedures

Use the Application graphic to determine stretch-outs required for the nominal thickness of insulation to limit average compression of the insulation 25% or less.

Performance

Thermal

Duct Wrap Roll with Thermal Conductivity of 0,035 w/mK and Thermal Resistance of 0.71 w2/mK.

Duct Wrap Roll Ultimate with Thermal Conductivity of 0.033 and Thermal Resistance of either 1.51 w2/mK and 0.79 w2/mK.

Duct Wrap Slab with Thermal Conductivity of 0.031 w/mK and Thermal Resistance of 1.61 w2/mK and 0.81 w2/mK.

Fire

Duct Wrap is tested and listed UL 723, ASTM E84

Classification (UL723)	FSK	Aluglass
Flame spread	not over 25	not over 25
Smoke developed	not over 50	not over 50

KNAUFINSULATION

DUCT LINER
INTERIOR INSULATION MATERIAL FOR SHEET METAL DUCTS

Atmosphere Duct Liner

- **Sound absorption options ranging between 0.50 to 0.80 NRC**
- **Provides an optimum combination of efficient sound absorption, low thermal conductivity and minimal airstream surface friction.**

- Eurofins Indoor Air Quality Gold Standard
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)

Products

Atmosphere™ Duct Liner is a flexible, mat-faced insulation bonded with ECOSE® Technology. It is faced with a tightly bonded mat to give the airstream a smooth, tough surface, resisting damage during installation and operation. The encapsulant edge coating eliminates airstream flaring.

Typical construction

Specifically designed as an interior insulation material for sheet metal ducts used in heating, ventilating and air conditioning. Provides an optimum combination of efficient sound absorption, low thermal conductivity and minimal airstream surface friction.

Installation

- Fabricate in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard.
- Liner shall be folded and compressed in the corners of rectangular duct sections or shall be cut and fit to assure lapped, compressed joints. Longitudinal joints in duct liner should not occur except at the corner of ducts. Longitudinal joints in liner shall be coated with adhesive.
  All damaged areas of the air stream surface shall be repaired with an adhesive which conforms to ASTM C 916.
- Liner should be adhered to the duct with 90% minimum area coverage of an adhesive which conforms to ASTM C 916.
- Mechanical fasteners should not compress the insulation more than 3mm, and shall be installed perpendicular to the duct surface. All fasteners should comply with the guidelines of NAIMA's Fibrous Glass Duct Liner Standard and the Mechanical Fastener's Standard MF-1-1975.
- Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at fan discharge, at access doors and at any interval of lined duct preceded by unlined duct.
  In addition, where velocities exceed 1219 mpm, metal nosing small be used on upstream edges of liner at every transverse joint.

Performance

Fire
Duct Liner is tested to ASTM E84

Classification (UL723)	WGF
Flame spread	not over 25
Smoke developed	not over 50

Acoustic
Duct liner Roll has an NRC of 0.75

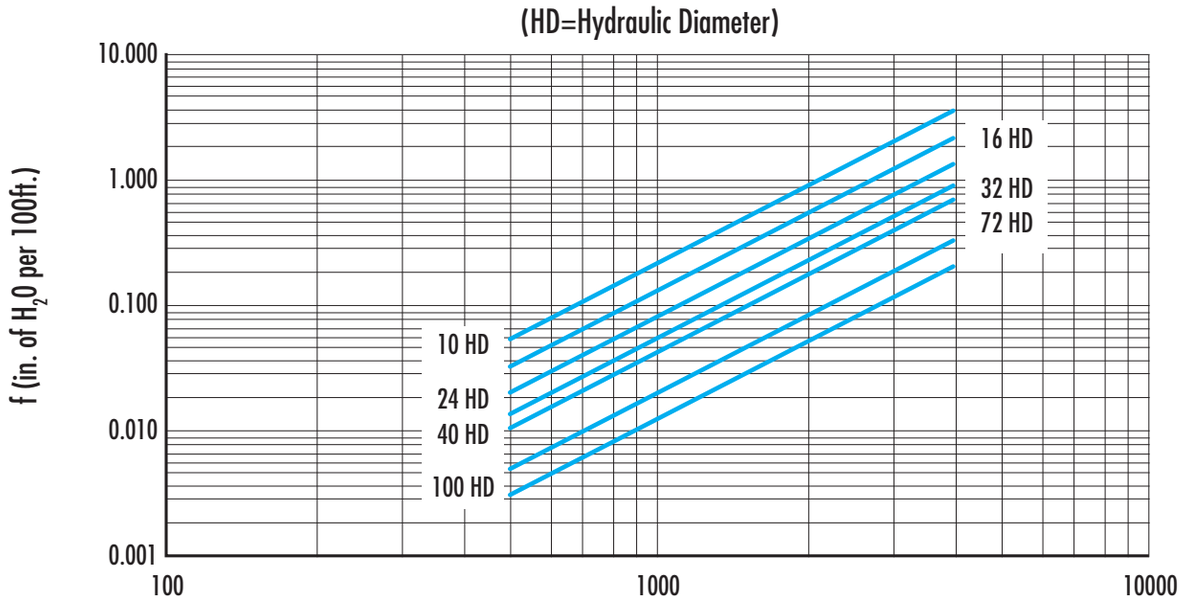
Duct Liner Roll Ultimate with 25 mm thickness has an NRC of 0.80

Duct Liner Roll Ultimate with 15 mm thickness has an NRC of 0.55

Duct Liner Slab with 25 mm thickness has an NRC of 0.80

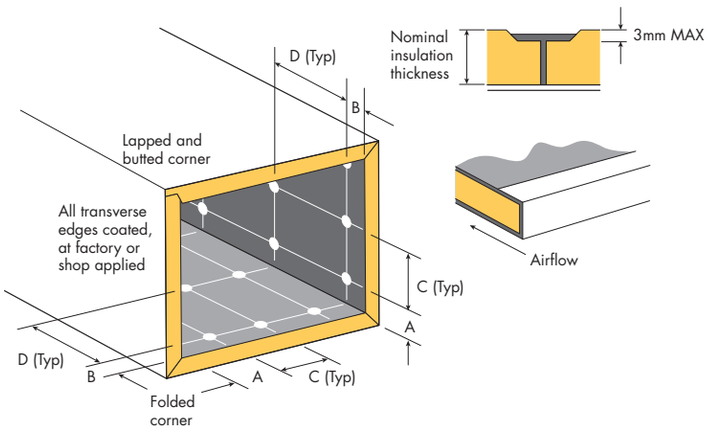
Air Velocity (ASTM C 1071)
Duct Liner Roll and Slab are performs to a maximum Airvelocity of 1829 mpm (Tested to 4572 mpm)

Friction Loss



FPM	Hydraulic diameter						
Velocity	254mm	406mm	610mm	813mm	1016mm	1823mm	2540mm
500	0.054	0.030	0.018	0.012	0.009	0.005	0.003
600	0.077	0.042	0.025	0.018	0.013	0.007	0.004
700	0.104	0.057	0.034	0.024	0.018	0.009	0.006
800	0.134	0.074	0.044	0.031	0.023	0.011	0.008
900	0.169	0.093	0.056	0.039	0.029	0.014	0.010
1000	0.207	0.114	0.068	0.048	0.036	0.018	0.012
2000	0.806	0.443	0.266	0.186	0.141	0.069	0.046
3000	1.797	0.988	0.594	0.415	0.315	0.153	0.103
4000	3.179	1.748	1.050	0.734	0.557	0.271	0.181
5000	4.952	2.724	1.636	1.143	0.867	0.422	0.283

Mechanical fastener location		
Velocity/FPM (m/sec)	0 - 12.7	12.7 - 25.4
A From corners of duct	102mm	102mm
B From transverse of duct	76mm	76mm
C Across width of duct on centres (min 1/side)	305mm	152mm
D Across length of duct on centres (min 1/side)	457mm	406mm



Liner interior width		
No. Pins	Inches	(mm)
0	≤8	≤203
2	9-16	229-406
3	17-28	432-711
4	29-40	737-1016
5	41-52	1041-1321
6	53-64	1346-1626
7	65-76	1651-1930
8	77-88	1956-2235
9	89-100	2261-2540

PIPE INSULATION
IRON AND COPPER PIPING, EXTERIORS OF PIPES

Knauf Pipe Insulation

- **For iron and copper piping for all hot, cold, concealed and exposed piping systems.**
- **Excellent resistance to heat loss or gain, which saves energy and lowers operating costs**

- Non Combustible Insulation
- Zero Ozone Depletion Potential (ODP)
- Zero Global Warming Potential (GWP)

Products

Knauf Insulation Pipe Insulation is a molded, heavy-density, one-piece insulation made from inorganic glasswool bonded with ECOSE® Technology. It is produced in 1.2 meter lengths with unfaced or with FSK, ASJ, Aluglass facing.

Installation

Precautions

Hot Pipe

- May be installed while the system is in operation, at all temperatures up to 232°C
- During initial heat-up to operating temperatures above 177°C, a slight odor and some smoke may be given off as a portion of the bonding material used in the insulation begins to undergo a controlled decomposition.
- If natural convection is not adequate in confined areas, forced ventilation should be provided in order to protect against any harmful fumes and vapors that might be generated.
- Care must also be taken when using sealants, solvents or flammable adhesive during installation.

Cold Pipe

- Use a continuous vapor retarder on piping operating below ambient temperatures.
- Seal all joints, surfaces, seams and fittings to prevent condensation.
- On chilled water systems operating in high humidity conditions, it is recommended that the same guidelines be followed as listed above for below freezing applications.
- Exterior hanger supports are recommended

Outside Application

- Do not expose pipe insulation to weather. It must be covered with appropriate jacketing, mastic or vapor retardant adhesives.
- Apply jacketing, mastics or vapor retardant adhesives per manufacturer's instructions. For metallic jackets, factory-applied condensate retarders are recommended.

General Guidelines

- All sections should be firmly butted.
- Seal circumferential joint with a minimum 76 mm wide butt strip.
- Jackets, coating and adhesives should have a comparable F.H.C. rating.
- All piping should have continuous insulation.
- Position longitudinal lap downward to avoid dirt and moisture
- Do not expose pipe insulation to

Recommended pipe insulation thickness

Chilled pipes			
Pipe temperature		Ambient conditions %90 R.H & 25 °C	
°F	°C	Pipe sizes (mm)	Thickness of pipe covering (mm)
35 - 49	1.5 - 9	Upto 50 60 - 350	40 60
30 - 70	10 - 21	Upto 20 25 - 250	25 40

Heated pipes			
Nom. Bare (mm)	O.D. (mm)	Thickness (mm)	
		100 °C	200 °C
10	17	25	40
15	21	25	50
20	27	30	50
32	42	40	60
40	48	40	60
50	60	50	60
65	76	50	70
80	89	50	75
90	102	50	75
100	114	65	80
150	168	60	90
250	273	70	100
300	324	70	110

excessive vibration or physical abuse.

- Faced insulation should not have a facing temperature above 100°C.

Density

All Knauf Insulation Pipe Insulation are 64 kg m3 density.

Performance

Thermal

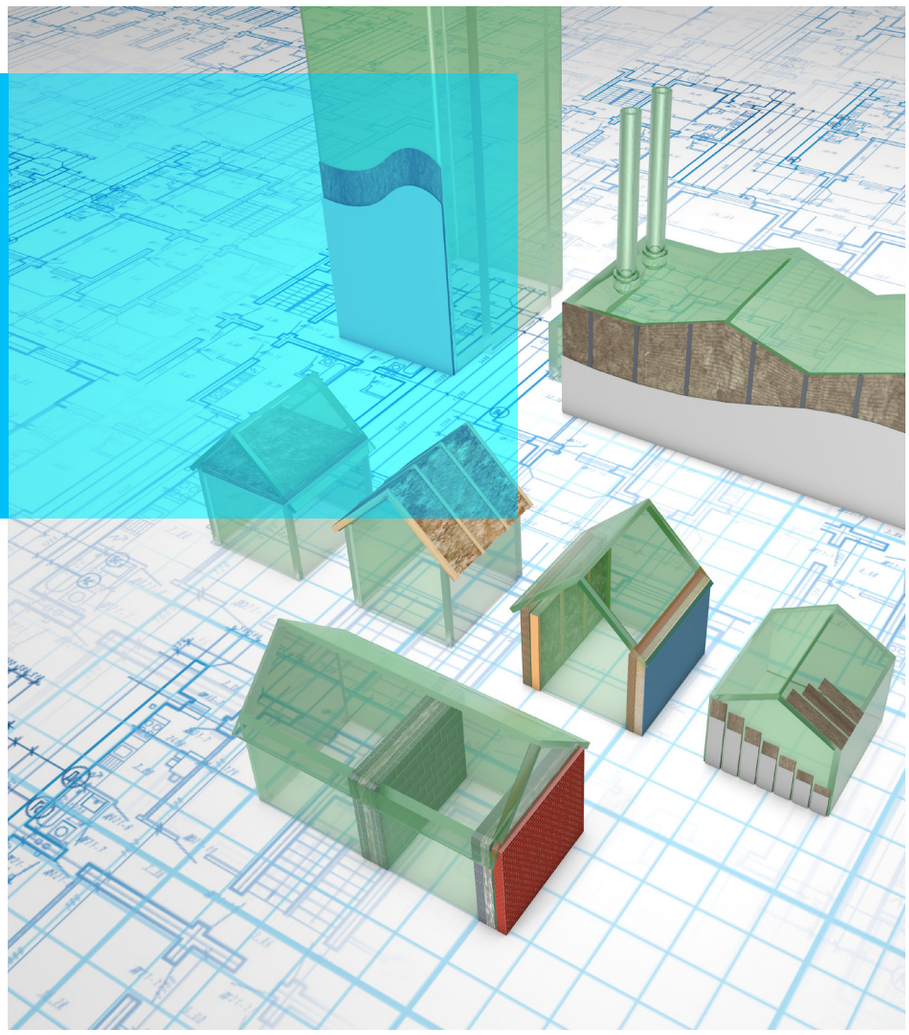
Knauf Insulation Pipe Insulation have a Thermal Conductivity of 0.030 w/mK.

Fire

Pipe Insulation tested and listed UL 723, ASTM E84

Classification (UL723)	Unfaced	FSK	WGF
Flame spread	not over 25	not over 25	not over 25
Smoke developed	not over 50	not over 50	not over 50

KNAUF INSULATION



CONTACTS

Customer Service (sales)
+971 2 551 2453

KSA Office
+966 12 683 6565

Technical Support & Marketing
+971 2 551 2453

Email
info@knaufexeedinsulation.ae

Knauf Exeed Insulation LLC Mussaffah ICAD 1, P.O.Box 34332, Abu Dhabi, United Arab Emirates

For more information please visit **www.knaufinsulation.ae**

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