

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. Although steel does not have the sustainability credentials of timber, it is fully recyclable and steel manufactured in the UK usually contains approximately 20% recycled content.

Light steel framed structures can be used for buildings up to six storeys high, although British Board of Agrément certificates limit some systems to four storeys. 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 75mm 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 national Building 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 class 1 surface spread of flame where it faces a cavity

External loadbearing steel framed walls typically comprise:

- Internal lining of 12.5 mm thick, Type 5 fire resistant plasterboard clad with 12.5 mm thick Type 1 vapour check 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 specified in the British Standard.

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.

Solution optimiser and pathfinder

Knauf Insulation solution

U-values

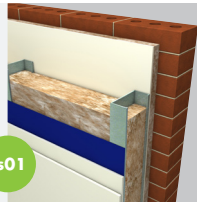
0.32 0.31 0.30 0.29 0.28 0.27 0.26 0.25 0.24 0.23 0.22 0.21 0.20 0.19 0.18 0.17 0.16

Glass mineral wool between studs with insulated sheathing

Product: Earthwool SteelTherm Roll 40

See page: 150

Ls01



Rock mineral wool between studs with insulated sheathing

Product: Earthwool Flexible Slab

See page: 150

Ls02



Glass mineral wool between studs, rock mineral wool behind rainscreen cladding system

Products: Earthwool SteelTherm Roll 40 and Earthwool RainScreen Slab

See page: 152

Ls03



Rock mineral wool between studs, and behind rainscreen cladding system

Products: Earthwool Flexible Slab and Earthwool RainScreen Slab

See page: 152

Ls04



Key

Thermal insulation achievable by constructions within this document.

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

Light steel frame walls

Glass or rock mineral wool between studs with insulated sheathing

Earthwool SteelTherm Roll 40 and Earthwool Flexible Slab



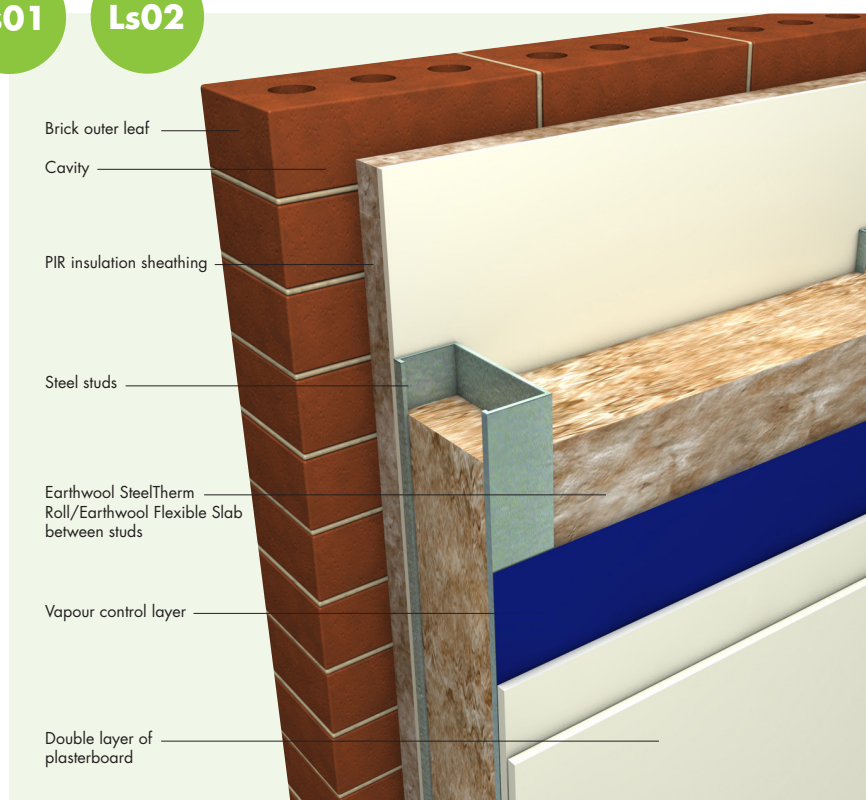
Ls01

Ls02

- 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
- Knauf Insulation 3D modelling calculation service provides optimised thermal performance

Earthwool SteelTherm Roll and Earthwool Flexible Slab

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



Products

Earthwool SteelTherm Roll 40 is a lightweight, flexible glass mineral wool roll.

Earthwool Flexible Slab is a multi purpose flexible, rock mineral wool slab designed for friction fitting between steel studs.

The manufacture of both products has a very low impact on the environment.

Typical construction

Inner leaf comprising a double layer of standard plasterboard, vapour control layer, Earthwool SteelTherm Roll 40 or Earthwool Flexible Slab between steel studs, PIR insulation board sheathing. 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.

Earthwool SteelTherm Roll 40 or Earthwool Flexible Slabs 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.

The foil faced PIR board is held in place by the steel framing used to support the outer cladding or temporarily fixed with suitable self-tapping screws and washers. Secondary fixings may be used where required.

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

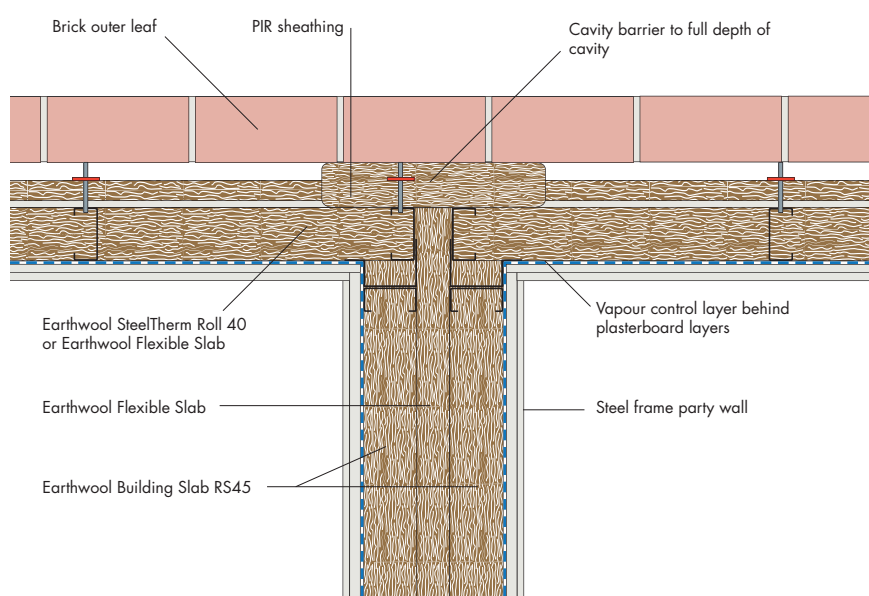
Earthwool SteelTherm Roll 40 has a thermal conductivity of 0.040 W/mK.

Earthwool Flexible Slab has a thermal conductivity of 0.035 or 0.037 W/mK.

Fire performance

Earthwool SteelTherm Roll 40 and Earthwool Flexible Slab are classified as Euroclass A1 to BS EN 13501-1.

Typical junction of external wall with party wall



Typical specification

External wall to be insulated between studs using Earthwool SteelTherm Roll 40* / Earthwool Flexible Slab.....mm thick* . Insulation to be cut as necessary and friction fitted between studs.

(*delete as appropriate)

The PIR outer sheathing boards to be fixed directly against the external face of the steel frame and temporarily fixed with suitable self-tapping screws and washers. 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 Building Regulations.



Alternatively, consult the National Building Specifications, Standard version clause/clauses... P10/210 and 310.....

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

Typical U-values for steel framed wall with Earthwool SteelTherm Roll 40 between the studs

Ls01	U-values (W/m ² K)		
	PIR thickness (mm)	90mm Earthwool SteelTherm Roll 40	140mm Earthwool SteelTherm Roll 40
	50	0.22	0.19
	45	0.23	0.20
	40	0.24	0.21
	35	0.26	0.22
	30	0.27	0.24
	25	0.29	0.25
	20	0.32	0.27



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 0.44m²/W.

Additional care should be taken to ensure the PIR board is installed correctly so that all the board-to-board joints are fully closed and that no air gaps penetrate this insulation layer.

Typical U-values for steel framed wall with Earthwool Flexible Slab between the studs

Ls02	U-values (W/m ² K)		
	PIR thickness (mm)	100mm Earthwool Flexible Slab	140mm Earthwool Flexible Slab
	50	0.21	0.18
	45	0.22	0.19
	40	0.24	0.20
	35	0.25	0.21
	30	0.27	0.23
	25	0.29	0.24
	20	0.31	0.26



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 0.44m²/W.

Additional care should be taken to ensure the PIR board is installed correctly so that all the board-to-board joints are fully closed and that no air gaps penetrate this insulation layer.

Light steel frame walls

Glass or rock mineral wool between studs, rock mineral wool behind rainscreen cladding

Earthwool SteelTherm Roll, Earthwool Flexible Slab and Earthwool RainScreen Slab



Ls03

Ls04

- 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
- Knauf Insulation 3D modelling calculation service provides optimised thermal performance

Earthwool SteelTherm Roll and Earthwool Flexible Slab and Earthwool RainScreen Slab

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



Products

Earthwool SteelTherm Roll 40 is a lightweight, flexible glass mineral wool roll.

Earthwool Flexible Slab is a multi purpose flexible, rock mineral wool slab designed for friction fitting between steel studs.

Earthwool RainScreen Slab is a rock mineral wool slab containing a water repellent additive, specially developed for rainscreen cladding applications.

The manufacture of all three products has a very low impact on the environment.

Typical construction

Inner leaf comprising a double layer of standard plasterboard, vapour control layer and Earthwool SteelTherm Roll 40 or Earthwool Flexible Slab between steel studs.

A cementitious board is fixed to the outside of the frame and insulated with Earthwool RainScreen Slabs fixed back to the cementitious board.

A range of rainscreen claddings can be applied, supported from brackets fixed back to the steel studs, a thermal break pad is incorporated between the brackets and the cementitious board.

Installation

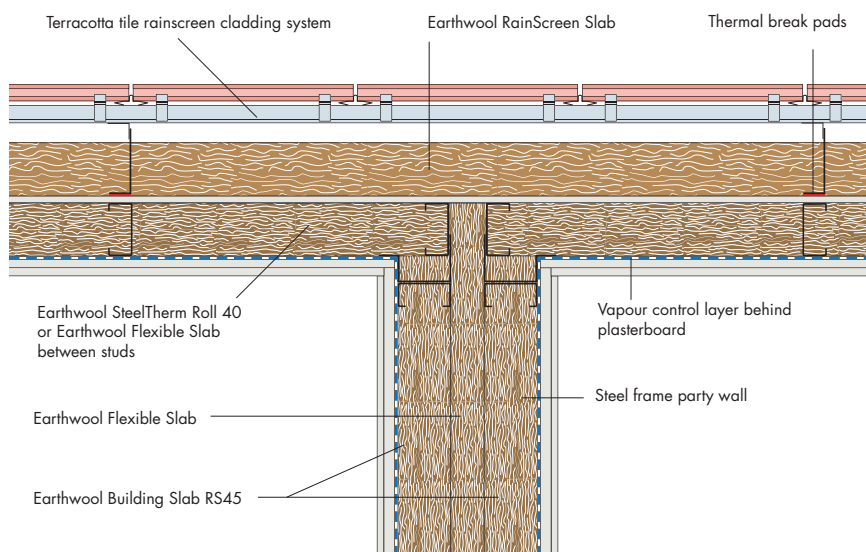
Cementitious boards are fixed to the exterior of the steel frame, Earthwool SteelTherm Roll 40 or Earthwool Flexible Slab are friction fitted between the studs at standard centres.

A vapour control layer is taped to the studs across the inner face of the wall before fixing the plasterboard layers. 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.

The rainscreen cladding support brackets are fixed to the steel frame (including thermal break pads) as required for the specific rainscreen system. Earthwool RainScreen Slabs are installed between the support brackets for the rainscreen cladding. 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.

Earthwool RainScreen Slabs should be closely butted together and fixed independently to the cementitious boards 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.

Typical junction of terracotta rainscreen cladding system and party wall



Performance

Thermal performance

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

Earthwool Flexible Slab has a thermal conductivity of 0.035 or 0.037 W/mK.

Earthwool RainScreen Slab has a thermal conductivity of 0.034 W/mK.

Fire performance

Earthwool SteelTherm Roll 40, Earthwool Flexible Slab and Earthwool RainScreen Slab are classified as Euroclass A1 to BS EN 13501-1.

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, namely BS 6946: 2007.

Accurate U-value calculations for rainscreen cladding systems can be generated by numerical modelling programs such as HEAT 3 which employ the methodologies detailed in BS EN ISO 10211.

Approved Documents ADL1A and ADL2A require BR443 - 'Conventions for U-value Calculations' to be consulted when U-values for rainscreen cladding systems are being compiled.

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 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.

Further information can be obtained from our Technical Support Team on 01744 766666.

Typical specification

External wall to be insulated between studs using Earthwool SteelTherm Roll 40/ Earthwool Flexible Slab*mm thick. Insulation to be cut as necessary and friction fitted between studs.

(*delete as appropriate)

Earthwool RainScreen Slabmm thick to be fixed independently to the cementitious board facing to the steel frame using proprietary insulation fasteners in accordance with the design specification.

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

Cavity barriers and fire stops should be installed as required to meet the Building Regulations.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses... P10/210 and 310 and H92/776.....

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