



August 2008: Issue 1

Residential Refurbishment 3.3.2 Timber frame walls



energy saving



warmth



quietness



fire protection



sustainability

Residential Refurbishment

Timber Frame Walls Contents

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Timber frame walls

Solution optimiser and pathfinder

Historically timber frame dwellings have included some insulation but not to today's standards. Upgrading insulation in existing dwellings is not always simple. Therefore Knauf Insulation offers a range of external frame wall products designed to easily achieve all Building Regulation requirements.

The simple option for timber framed dwellings is to fit an insulated liner board so that the insulation and plasterboard are fitted in one process. The installation of an insulated linerboard in conjunction with Crown FrameTherm improves both the thermal and acoustic performance of the wall whilst also reducing the effect of cold bridging through the timber studs. A 50mm cavity separates the timber frame from the outer leaf (typically of brick).

Key

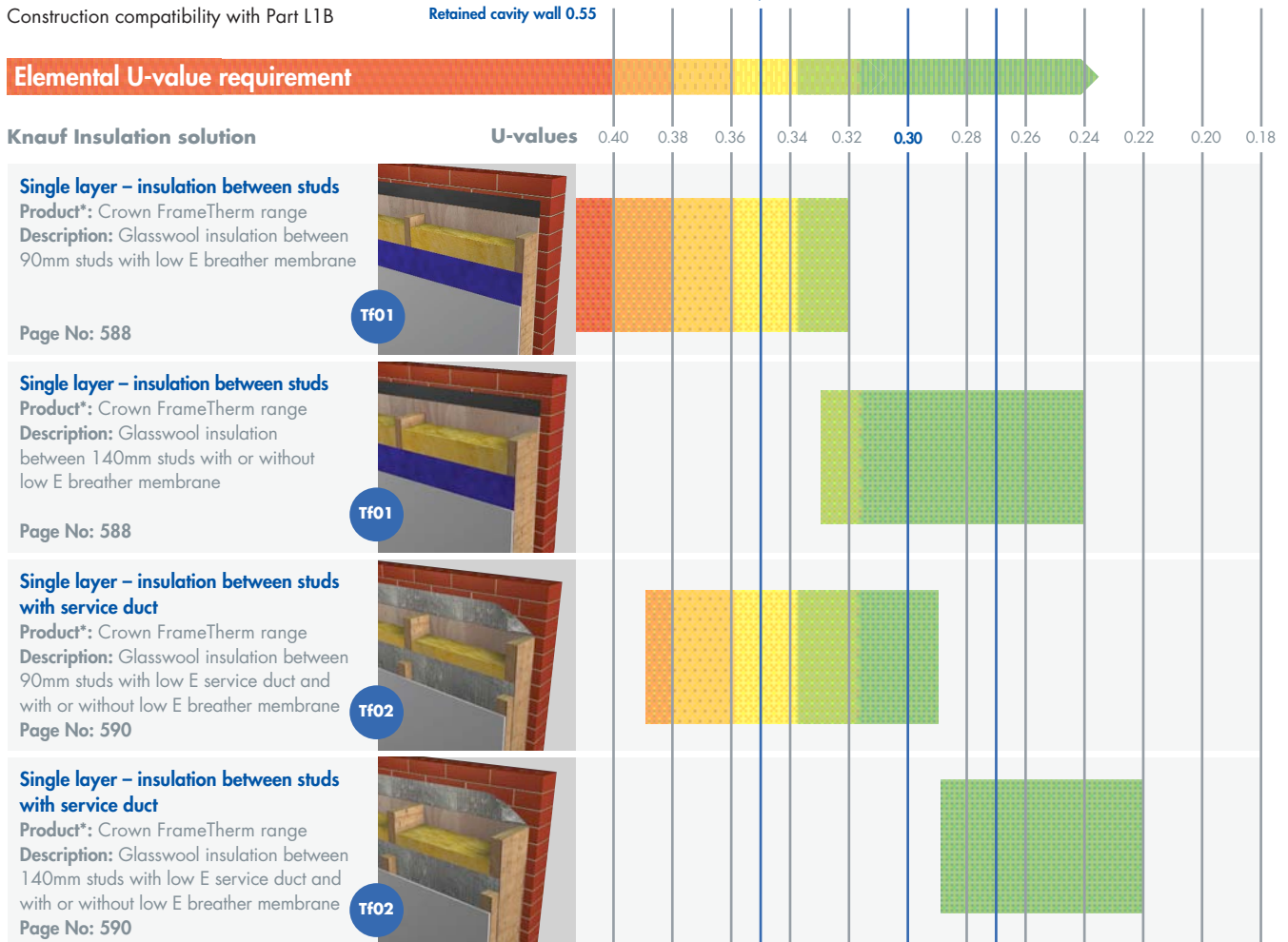
 U-values achievable by constructions within this document.

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

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

External timber frame walls

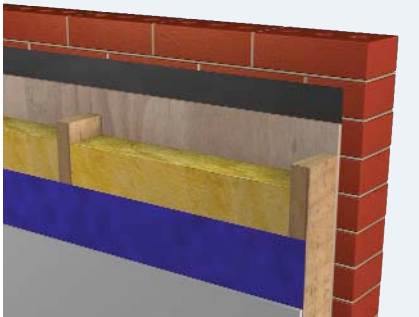
Construction compatibility with Part L1B



Single layer

Crown FrameTherm between the studs

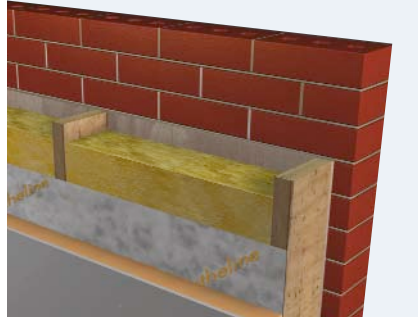
- Traditional and straightforward installation
- Insulation fitted in one process
- Utilises non-combustible to Euroclass A1 insulation throughout



Double layer

Crown FrameTherm between the studs and Polyfoam Linerboard inside the studs

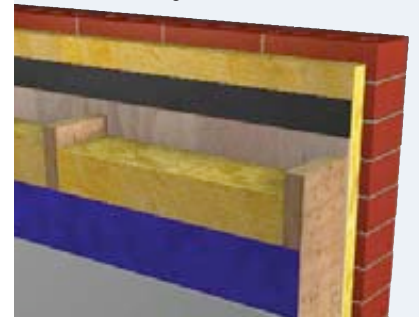
- Lower U-values within same system width
- Easy installation of secondary insulation layer as it combines a sheet of plasterboard



Twin insulated

Crown FrameTherm between the studs and Crown DriTherm Cavity Slab in the cavity

- Lowest U-values
- Lowest system width (full fill)
- No need for firestopping (full fill)
- Utilises non-combustible to Euroclass A1 insulation throughout



External timber frame walls

Construction compatibility with Part L1B

Elemental U-value requirement

Knauf Insulation solution

Retained cavity wall 0.55

U-values

0.40 0.38 0.36 0.34 0.32 0.30 0.28 0.26 0.24 0.22 0.20 0.18

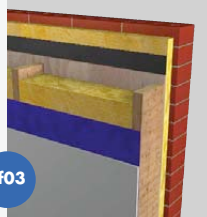
Insulation between studs with insulated lining

Products*: Crown FrameTherm range and Polyfoam Linerboard

Description: Glasswool insulation between 90mm studs with XPS insulated plasterboard

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Tf03



Insulation between studs with insulated lining

Products*: Crown FrameTherm range and Polyfoam Linerboard

Description: Glasswool insulation between 140mm studs with XPS insulated plasterboard

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Tf03



Insulation between studs and to exterior of sarking

Products*: Crown FrameTherm range and Crown DriTherm Cavity Slab range

Description: Glasswool insulation between 90mm studs and glasswool cavity slab insulation to exterior of sarking fully filling the cavity

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Tf04



Insulation between studs and to exterior of sarking

Products*: Crown FrameTherm range and Crown DriTherm Cavity Slab range

Description: Glasswool insulation between 140mm studs and glasswool cavity slab insulation to exterior of sarking partially filling the cavity

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Tf04



Extensions England, Wales and N.I.
Max U-value for replacement and upgraded thermal elements - England and Wales and Northern Ireland
Extensions Scotland

Timber frame walls

Timber frame design



Constructing a timber frame in a factory

Timber frame construction is the developed world's most widely used residential building method. It fulfils a 21st century agenda, offering a method of construction which is engineered, energy efficient, sustainable and quality assured. With a huge supply of plantation timber readily available in the UK and Ireland this form of construction is very environmentally friendly.

Overview

Insulated external timber frame walls can provide better insulation performance than masonry walls of comparable thickness.

Timber frame is also widely recognised as the most environmentally friendly construction method – a construction with extremely low 'embodied energy'. This is the energy required to manufacture a building component or material, deliver it to site and install or construct. In this respect timber frame performs much better than standard masonry construction. Timber frame offers unique advantages to home owners, builders and contractors:

- Construction is faster
- A wide range of U-values can be achieved depending on Building Regulations requirement
- Excellent thermal efficiency
- Potential for easy future renovation
- Pre-fabrication enhances quality control due to off site manufacture, thereby reducing the risk of on-site workmanship problems
- Relatively light weight requiring reduced footings and foundations compared to masonry construction

The importance of condensation control

A vapour control layer is essential on the 'warm' side of the insulation to reduce the risk of condensation forming within the timber frame. The vapour control layer may be incorporated within the plasterboard or installed separately. Joints should be as few as possible and sealed, with special care taken around penetrations for services.

A breather membrane on the outside of the sheathing is also necessary to protect against water penetration whilst allowing water vapour to escape.

As a rule of thumb, the vapour resistance of the materials on the 'warm' side of the insulation should have at least five times the vapour resistance of the materials on the 'cold' side of the insulation. Alternatively calculations should be carried out to assess the risk of interstitial condensation by referring to BS 5250.

In some timber framed systems, such as the Twin Insulated, the insulation in the cavity maintains the timber frame above the dewpoint temperature thus reducing the condensation risk even further. If in doubt call the Knauf Insulation Academy Technical Advisory Centre for a free condensation risk calculation.

Timber frame and fire performance

A half hour fire resistance in domestic external walls is required by the Building Regulations. Timber frame walls with mineral wool insulation are ideal for meeting this requirement.

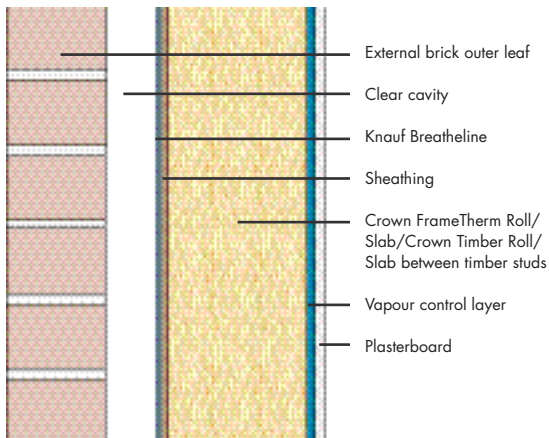
In most timber frame constructions, cavity barriers must be used to divide up the external cavity in order to reduce the risk of fire spread. In the Twin Insulated system, cavity barriers are not necessary because the cavity is completely filled with non-combustible mineral wool insulation.

Twin Insulated Crown FrameTherm and Crown DriTherm Cavity Slab

This system is unique to Knauf Insulation and has been developed to meet the demand for higher insulation values in timber frame construction. It consists of a standard timber frame wall on the inside, a cavity fully or partially filled with Crown DriTherm Cavity Slab and an outer leaf of brickwork cladding. The system can be used in any type of building up to three storeys.

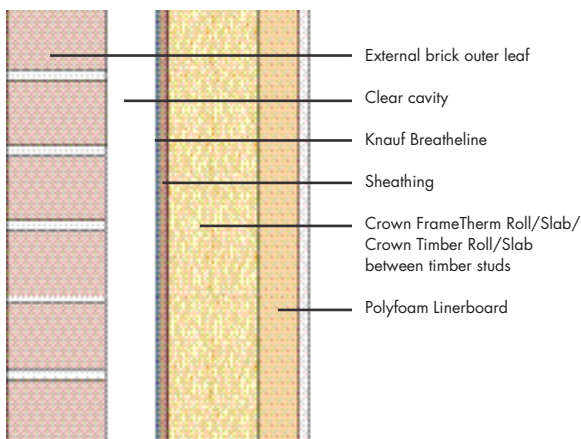
Three methods for insulating timber frame construction

1) Single layer – insulation between the studs

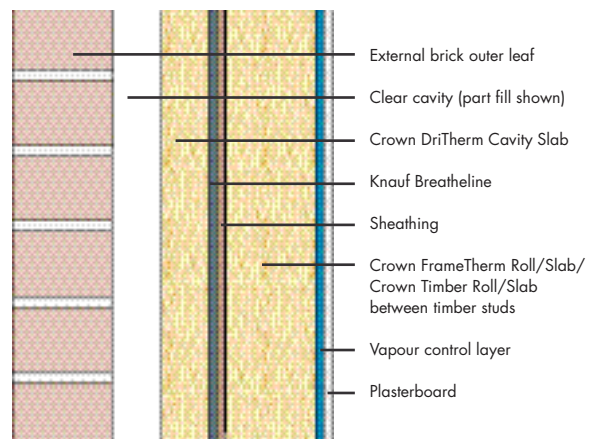


Cutting Crown FrameTherm to size to friction fit between narrowly spaced timber studs

2) Double layer – insulation between the studs and insulated dry lining



3) Twin Insulated – insulation between the studs external to sheathing



design detail finder

Knauf Insulation solutions for these types of construction can be found on pages 588-597

Timber frame walls

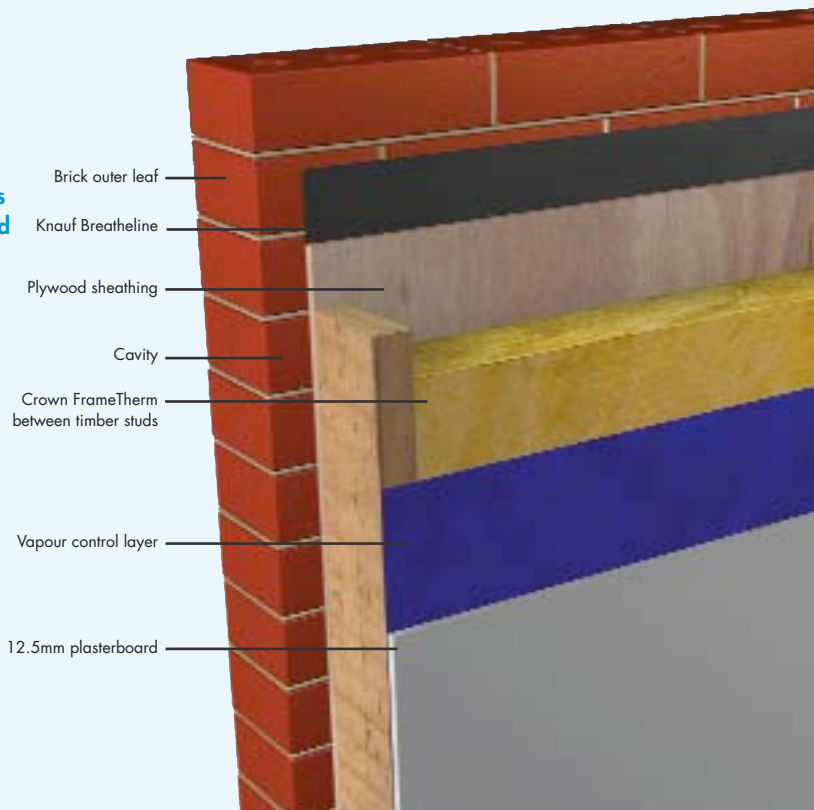
Single layer – insulation between studs



Tf01

Advantages

- ✓ Low cost
- ✓ Lightweight and easy to cut
- ✓ Much faster to install than rigid foam boards which require very accurate cutting
- ✓ Sized to fit tightly between standard stud widths without any cutting on site
- ✓ The insulation is compressible, where cutting is required cut the insulation slightly oversize and friction fit between the timber studs thereby preventing cold air penetrating through joints between the insulation and the timber
- ✓ The insulation is fitted in one process
- ✓ Completely fire-safe non combustible product
- ✓ Improves acoustic insulation of the walls
- ✓ Crown FrameTherm is a Zero ODP and Zero GWP insulation product
- ✓ The manufacture of Crown FrameTherm products has a very low impact on the environment



Products

Crown FrameTherm Roll/Slab is a lightweight glass mineral wool available in both slab and roll form and a range of thermal conductivities. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

Inner leaf comprising 12.5mm plasterboard, vapour control layer, Crown FrameTherm Roll/Slab between studwork, plywood sheathing and Knauf Breatheline, breathable membrane. A 50mm cavity separates the timber frame from the outer leaf, typically of brick. Other cladding options, such as tile hanging and timber boarding can also be utilised.

Installation

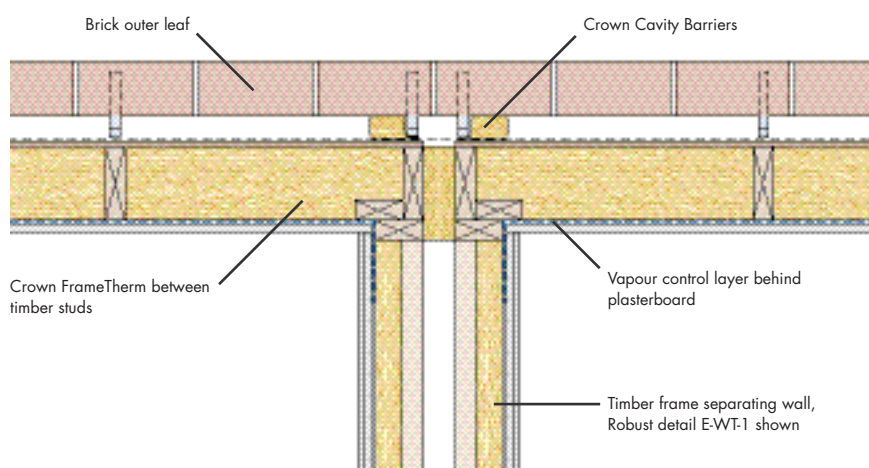
Knauf Insulation products are dimensioned to suit studs 90 or 140 mm at standard 600mm centres. The nominal thickness of the insulation should not be greater than the nominal stud depth.

Crown FrameTherm Roll/Slabs are friction fitted between studs at standard centres and are self supporting. Generally, two slabs fully fill the space between sole and head plates for standard floor to ceiling height.

A vapour control layer is stapled 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, tears repaired and overlaps and apertures for services effectively sealed. Particular care is necessary around electrical boxes.

Knauf Breatheline or other standard breather membrane should be stapled or nailed to the sheathing board at maximum 500mm centres. It should be lapped so that each joint is protected, with upper layers lapped over lower layers to shed water away from the sheathing. Horizontal laps should be at least 100mm wide and the membrane should extend below the lowest timber member. Vertical laps should be at least 150mm and be staggered.

Typical junction of external and separating wall



Typical specification

External wall panels to be insulated between studs using Crown FrameTherm 43*/40*/38*/35*/32*/Slab*.....mm thick

(*Delete as appropriate).

Insulation to be cut as necessary and friction fitted between studs.

The breather membrane stapled*/nailed* to the sheathing and extending below the lowest timber member

(*delete as necessary).

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



Alternatively, refer to NBS clause P10/210.

Table 41: Typical U-values for prefabricated timber framed walls

Product	U-values (W/m ² K)			
	Thickness (mm)	Breather membrane	Masonry outer leaf	Tile/timber clad outer leaf
Crown FrameTherm 32	140 (90+50)	Knauf Breatheline	0.26	0.28
	90	Knauf Breatheline	0.37	0.40
	140 (90+50)	Low E breather	0.24	0.27
	90	Low E breather	0.32	0.38
Crown FrameTherm 35	140	Knauf Breatheline	0.27	0.29
	90	Knauf Breatheline	0.38	0.42
	140	Low E breather	0.25	0.28
	90	Low E breather	0.34	0.40
Crown FrameTherm 38	140	Knauf Breatheline	0.29	0.31
	90	Knauf Breatheline	0.40	0.44
	140	Low E breather	0.26	0.29
	90	Low E breather	0.35	0.42
Crown FrameTherm 40	140	Knauf Breatheline	0.29	0.32
	90	Knauf Breatheline	0.41	0.46
	140	Low E breather	0.26	0.30
	90	Low E breather	0.36	0.43
Crown FrameTherm 43	140	Knauf Breatheline	0.31	0.33
	90	Knauf Breatheline	0.43	0.48
	140	Low E breather	0.28	0.32
	90	Low E breather	0.37	0.44

Notes: The U-values have been calculated to BS EN ISO 6946: 1997 and BR 443. Studs assumed to be 38mm wide at 600mm centres (allowances for sole plates etc, give a 15% bridging area for the timber). Stud depth is taken to be the same as the thickness of insulation specified. Thermal conductivity of timber studs is 0.120W/mK. Ventilated low emissivity airspace assumed to increase the R value of the cavity to 0.29 Wm²/K and unventilated low emissivity airspace assumed to increase R value of cavity to 0.44 m²K/W as specified in BR443. Higher values can be achieved with proprietary products. Please contact Knauf Insulation Technical Advisory Centre for calculations that include specific products.

Performance

Thermal performance

Crown FrameTherm Slab 43 – 0.043 W/mK.

Crown FrameTherm Roll 40 – 0.040 W/mK.

Crown FrameTherm Slab 38 – 0.038 W/mK.

Crown FrameTherm Roll/Slab 35 – 0.035 W/mK.

Crown FrameTherm Roll/Slab 32 – 0.032 W/mK.

Table 41 gives U-values for typical prefabricated timber frame walls insulated with Crown FrameTherm products.

Fire performance

Crown FrameTherm is classified as Euroclass A1 to BS EN ISO 13501-1.

Building Regulations state that external walls in domestic construction shall achieve half hour fire resistance. In tests and assessments carried out by TRADA Technology Ltd in accordance with BS 476: Part 21: 1987, different timber frame external walls incorporating Crown FrameTherm provided the required fire resistance.

Timber frame walls

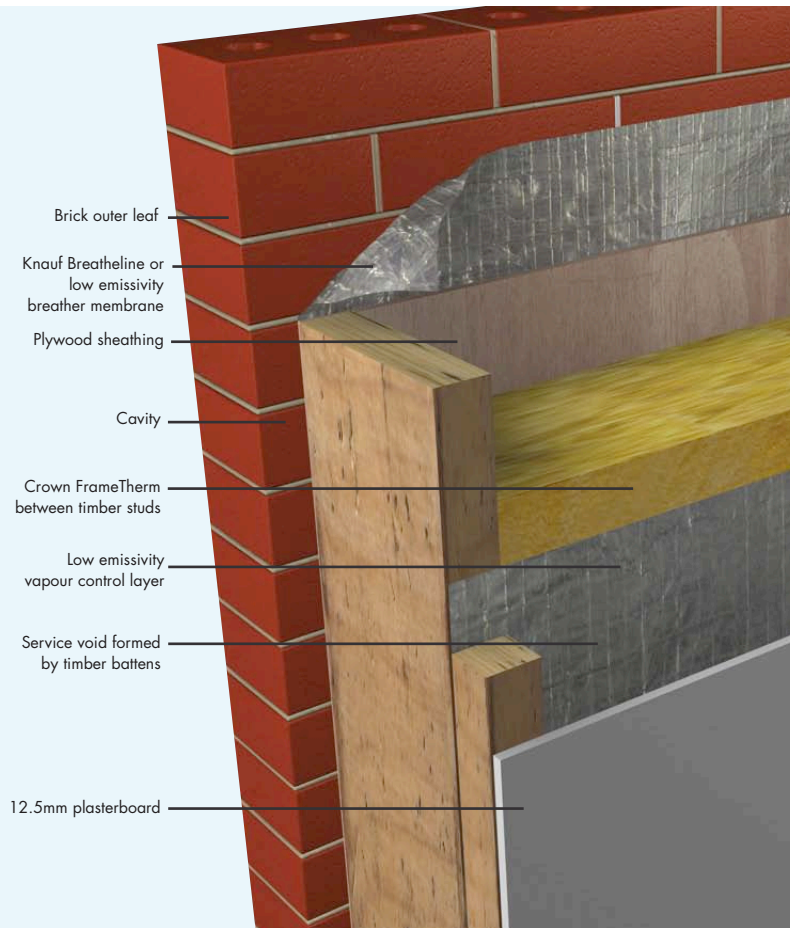
Single layer – insulation between studs with service void



Tf02

Advantages

- ✓ Lightweight and easy to cut
- ✓ Much faster to install than rigid foam boards which require very accurate cutting
- ✓ Sized to fit tightly between standard stud widths without any cutting on site
- ✓ The insulation is compressible, where cutting is required cut the insulation slightly oversize and friction fit between the timber studs thereby preventing cold air penetrating through joints between the insulation and the timber
- ✓ The insulation is fitted in one process
- ✓ Completely fire-safe non combustible product
- ✓ Improves acoustic insulation of the walls
- ✓ Crown FrameTherm is a Zero ODP and Zero GWP insulation product
- ✓ The manufacture of Crown FrameTherm has a very low impact on the environment
- ✓ Service ducts provide both a void for services and insulation value
- ✓ Providing a service duct increases the likelihood that the vapour control layer will remain complete when services are fitted



Products

Crown FrameTherm Roll/Slab is a lightweight glass mineral wool available in both slab and roll form and a range of thermal conductivities. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

Standard timber frame construction, with a brick outer leaf and a low emissivity vapour control layer to the inner face of the timber frame.

A service duct is formed by nailing 50x25mm timber battens to the timber frame before fixing the 12.5mm plasterboard internal lining.

Other cladding options, such as tile hanging and timber boarding can be utilised.

Installation

Knauf Insulation products are dimensioned to suit studs at standard 600mm centres. The nominal thickness of the insulation should not be greater than the nominal stud depth.

Crown FrameTherm Roll/Slabs are friction fitted between studs at standard centres and are self supporting. Generally, two slabs fully fill the space between sole and head plates for standard floor to ceiling height.

A low emissivity vapour control layer is stapled to the studs across the inner face of the wall with the low emissivity side facing internally. 50x25mm vertical timber battens are nailed to the timber studs before fixing the plasterboard. The vapour control layer should be free from holes. Any gaps should be made good, tears repaired and overlaps sealed with aluminised tape.

Knauf Breatheline should be stapled or nailed to the sheathing board at maximum 500mm centres. It should be lapped so that each joint is protected, with upper layers lapped over lower layers to shed water away from the sheathing. Horizontal laps should be at least 100mm wide and the membrane should extend below the lowest timber member. Vertical laps should be at least 150mm and be staggered.

Performance

Thermal performance

Crown FrameTherm Slab 43 – 0.043 W/mK.

Crown FrameTherm Roll 40 – 0.040 W/mK.

Crown FrameTherm Slab 38 – 0.038 W/mK.

Crown FrameTherm Roll/Slab 35 – 0.035 W/mK.

Crown FrameTherm Roll/Slab – 0.032 W/mK.

Table 42 gives U-values for typical prefabricated timber frame walls insulated with Crown FrameTherm products.

Typical junction of external and separating wall

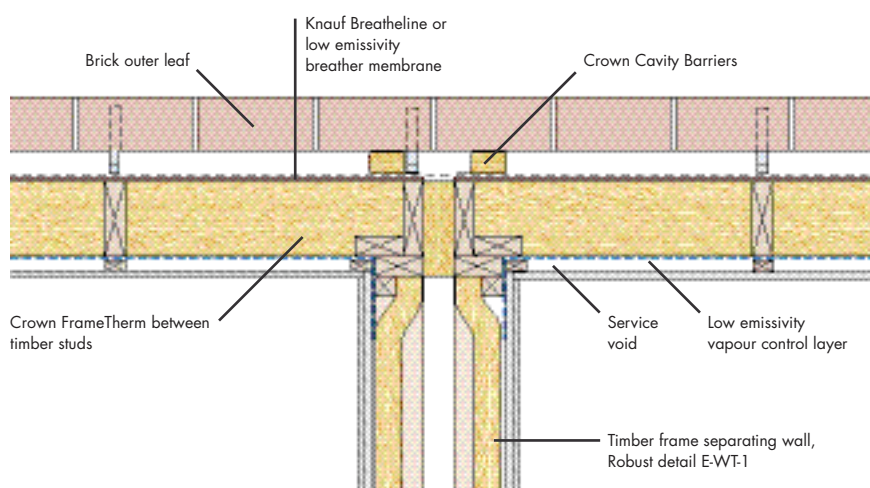


Table 42: Typical U-values for prefabricated timber framed wall with insulation between the studs and a service void

Product	U-values (W/m ² K)			
Including a 25mm low emissivity service void	Thickness (mm)	Breather membrane	Masonry outer leaf	Tile/timber clad outer leaf
Crown FrameTherm 35	140	Knauf Breatheline	0.24	0.26
	90	Knauf Breatheline	0.33	0.35
	140	Low E breather	0.23	0.25
	90	Low E breather	0.30	0.33
Crown FrameTherm 38	140	Knauf Breatheline	0.25	0.27
	90	Knauf Breatheline	0.34	0.37
	140	Low E breather	0.24	0.26
	90	Low E breather	0.31	0.35
Crown FrameTherm 40	140	Knauf Breatheline	0.26	0.28
	90	Knauf Breatheline	0.35	0.38
	140	Low E breather	0.24	0.26
	90	Low E breather	0.32	0.35
Crown FrameTherm 43	140	Knauf Breatheline	0.27	0.29
	90	Knauf Breatheline	0.36	0.39
	140	Low E breather	0.25	0.27
	90	Low E breather	0.39	0.37

Notes: Low emissivity values taken from BR443. Thermal conductivity of timber studs is 0.120 W/mK.

Typical specification

External wall panels to be insulated between studs using Crown FrameTherm 43*/40*/38*/35*/32*.....mm thick (*Delete as appropriate). Insulation to be cut as necessary and friction fitted between studs.

The breather membrane stapled*/nailed* to the sheathing and extending below the lowest timber member (*Delete as appropriate).

Form service void with 50x25mm timber battens as shown on the drawings.

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



Alternatively, refer to NBS clause P10/210

Fire performance

Crown FrameTherm is classified as Euroclass A1 to BS EN ISO 13501-1.

Building Regulations state that external walls in domestic construction shall achieve half hour fire resistance. In tests and assessments carried out by TRADA Technology Ltd in accordance with BS 476: Part 21: 1987, different timber frame external walls incorporating Crown FrameTherm gave the required fire resistance.

Timber frame walls

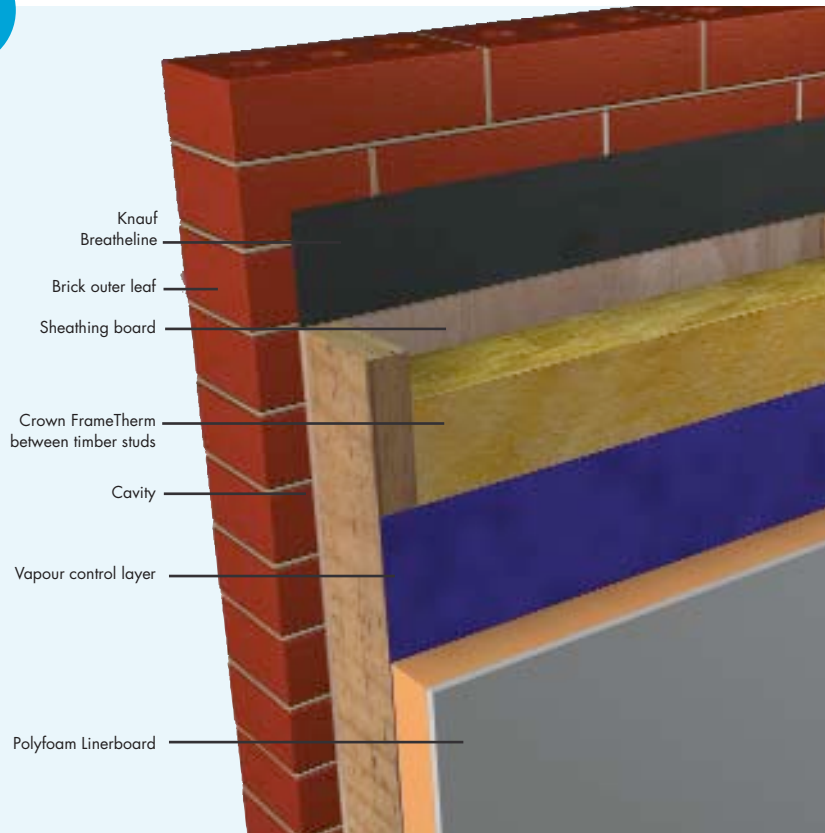
Insulation between studs with insulated lining



Tf03

Advantages

- ✓ Improves U-values of walls, within same stud depth
- ✓ Between stud insulation is lightweight and easy to cut
- ✓ Much faster to install between studs than rigid foam boards which require very accurate cutting
- ✓ Sized to fit tightly between standard stud widths without any cutting on site
- ✓ The insulation is compressible, where cutting is required cut the insulation slightly oversize and friction fit between the timber studs thereby preventing cold air penetrating through joints between the insulation and the timber
- ✓ Improves acoustic insulation of the walls
- ✓ Crown FrameTherm are Zero ODP and Zero GWP insulation products
- ✓ The manufacture of Crown FrameTherm products has a very low impact on the environment



Products

Crown FrameTherm Roll/Slab is a lightweight glass mineral wool available in both slab and roll form and a range of thermal conductivities. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Polyfoam Linerboard is a laminate of Polyfoam high performance 100% ozone friendly extruded polystyrene, rigid board insulation and 9.5mm plasterboard.

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A 90mm deep timber frame stud wall infilled with Crown FrameTherm and faced internally with Polyfoam Linerboard and externally with plywood sheathing and Knauf Breatheline. The use of an insulated plasterboard laminate improves the thermal performance and reduces thermal bridging through the timber studs. A 50mm cavity separates the timber frame from the outer leaf, typically of brick.

Installation

Knauf Insulation products are dimensioned to suit studs of 90 or 140mm at standard 600mm centres. The nominal thickness of the insulation should not be greater than the nominal stud depth.

Crown FrameTherm is friction fitted between studs at standard centres and is self supporting. Subsequently, Polyfoam Linerboard is screwed to the timber frame at maximum 150mm centres. The boards are taper edged and should be finished using standard drylining techniques.

Knauf Breatheline should be stapled or nailed to the sheathing board at maximum 500mm centres. It should be lapped so that each joint is protected, with upper layers lapped over lower layers to shed water away from the sheathing.

Horizontal laps should be at least 100mm wide and the membrane should extend below the lowest timber member. Vertical laps should be at least 150mm and be staggered.

Performance

Thermal performance

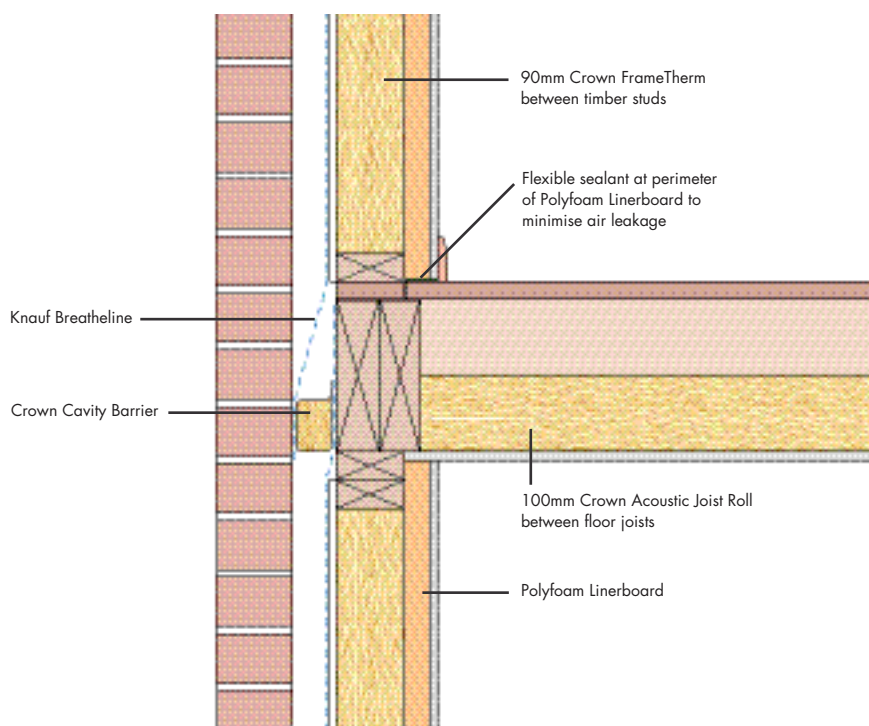
Crown FrameTherm Roll 40 has a thermal conductivity of 0.040 W/mK.

Crown FrameTherm 32 has a thermal conductivity of 0.032 W/mK.

The insulation element of Polyfoam Linerboard has a thermal conductivity of 0.030 W/mK and the plasterboard has a thermal conductivity of 0.19 W/mK.

Table 43 gives U-values for typical prefabricated timber frame walls lined internally with various thicknesses of Polyfoam Linerboard.

Typical junction of external wall and upper floor



Note: In order to prevent plasticiser migration, PVC insulated cables and pipes should be installed in service conduits or wrapped in aluminium foil faced tape.

Fire performance

Crown FrameTherm is classified as Euroclass A1 to BS EN ISO 13501-1

Building Regulations state that external walls in domestic construction shall achieve half hour fire resistance. In tests and assessments carried out at Trada Technology Ltd in accordance with BS 476: Part 21: 1987, different timber frame external walls incorporating Crown FrameTherm gave the required fire resistance. To meet the half hour requirement using Polyfoam Linerboard it will be necessary to line the wall with 12.5mm plasterboard before installing the Polyfoam Linerboard.

Typical specification

External wall panels to be insulated between studs using Crown FrameTherm 40*/32*mm thick (*delete as necessary). Insulation to be cut as necessary and friction fitted between studs.

The wall panels to be lined internally with Polyfoam Linerboard,mm thick with integral 9.5mm plasterboard screwed to the timber studs at maximum 150mm centres.

Knauf Breatheline stapled*/nailed* to the sheathing and extending below the lowest timber member (*Delete as appropriate). Cavity barriers and fire stops should be installed as required to meet the Building Regulations.

Alternatively, refer to NBS clauses: P10/210 and K10/205



Table 43: Typical U-values for prefabricated timber framed walls with an internal lining

Insulation product	U-values (W/m ² K)			
	Thickness (mm)	Polyfoam Linerboard thickness (mm)	Masonry outer leaf	Tile/timber clad outer leaf
Crown FrameTherm 40	140	36/9.5	0.22	0.23
	140	25.5/9.5	0.23	0.25
	140	17.5/9.5	0.25	0.27
	90	36/9.5	0.28	0.29
	90	25/9.5	0.31	0.33
	90	17.5/9.5	0.33	0.36
Crown FrameTherm 32	140	36/9.5	0.20	0.21
	140	25.5/9.5	0.21	0.22
	140	17.5/9.5	0.22	0.24
	90	36/9.5	0.25	0.27
	90	25/9.5	0.28	0.30
	90	17.5/9.5	0.30	0.32

Notes: The U-values have been calculated to BS EN ISO 6946: 1997 and BR 443. Studs assumed to be 38mm wide at 600mm centres (allowances for sole plates etc, give a 15% bridging area for the timber). Stud depth is taken to be the same as the thickness of insulation specified. Thermal conductivity of timber studs is 0.120 W/mK

Timber frame walls

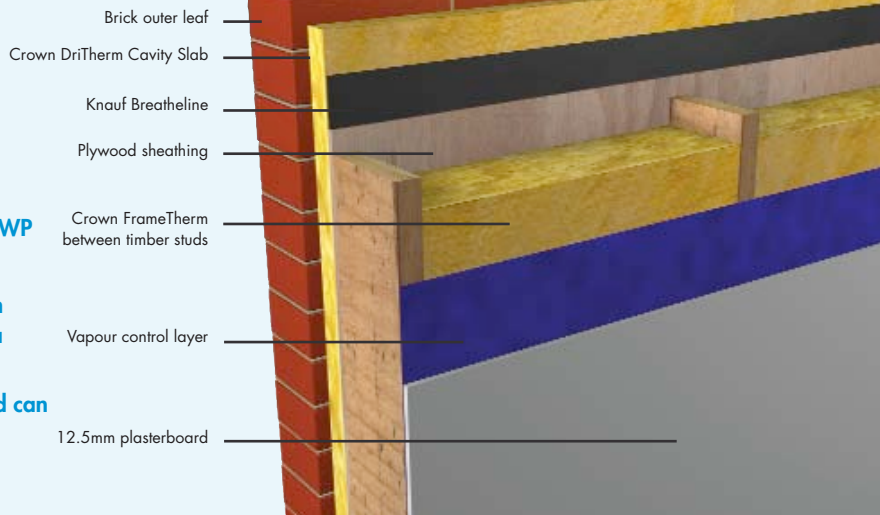
Insulation between studs and to exterior of sarking



Tf04

Advantages

- ✓ Very low U-values can be achieved
- ✓ No need for firestopping (full-fill)
- ✓ Utilises non-combustible Euroclass A1 insulation throughout
- ✓ Partial fill system accepted by NHBC
- ✓ Crown FrameTherm and Crown DriTherm 37 are Zero ODP and Zero GWP insulation products
- ✓ The manufacture of Crown FrameTherm and Crown DriTherm 37 products has a very low impact on the environment
- ✓ Crown FrameTherm is compressible and can be cut slightly oversize to friction fit between the studs preventing cold air penetrating through joints



Products

Crown FrameTherm Roll/Slab is a lightweight glass mineral wool available in both slab and roll form and a range of thermal conductivities. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown DriTherm Cavity Slab 37 is a semi-rigid, non-combustible glass mineral wool slab containing a water-repellent additive. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

Inner leaf comprising 12.5mm plasterboard, vapour control layer, Crown FrameTherm between studwork, 9.5mm plywood sheathing and Knauf Breatheline. Cavity between timber frame and outer leaf either fully or part filled with Crown DriTherm Cavity Slab 37. Outer leaf typically of brick.

Installation

The installation of Crown FrameTherm, vapour control layer and Knauf breatheline are the same as for solution Tf01. If a service void is to be included then refer to Tf02. The principles for installing Crown DriTherm Cavity Slab 37 in a twin insulated wall are essentially the same as for installation in a masonry cavity wall when the inner leaf is constructed first.

The instructions to be found in British Board of Agrément Certificate 95/3212 apply to the use of Crown DriTherm Cavity Slabs in masonry wall constructions and can therefore be deemed relevant to this application. The BBA Certificate does not cover the specific use of Crown DriTherm Cavity Slab 37 in timber frame walls.

Installation sequence – full-fill

The timber frame is erected in the normal manner. The sequence and methods are the same as for conventional timber frame except that small cavity barriers are omitted from the cavity, as Crown DriTherm Cavity Slab 37 is non-combustible and therefore performs the function of a small cavity barrier. Crown DriTherm Cavity Slab 37 should fully fill the space between the external cladding and the timber frame. Adjacent slabs should always be close butted leaving no gaps. Any mortar droppings or other debris lying on the top edge of a slab, must be removed before installing the next row above. The construction sequence ensures there is no cavity into which debris can fall to an irretrievable position. Adoption of these principles will ensure that any rainwater penetrating the outer leaf is not transmitted to the timber frame.

Note that the NHBC will not accept this form of construction on projects where their guarantee is required.

Installation sequence – part fill

The timber frame is erected in the normal manner. The sequenced method is the same as for conventional timber frame except that a wider cavity than normal is used.

This will require longer than normal wall ties with a clip to hold the Crown DriTherm Cavity Slab 37 back to the timber frame wall. Small cavity barriers should be installed to the full width of the cavity. Crown DriTherm Cavity Slab 37 is installed to the same standard as for full-fill, but should be fully clipped back to the timber frame wall.

Note The NHBC will accept this form of construction providing a 50mm residual cavity between the Crown DriTherm Cavity Slab 37 and masonry outer leaf is maintained.

Performance

Thermal performance

Crown DriTherm Cavity Slab 37 has a thermal conductivity of either 0.035 or 0.037 W/mK.

Crown FrameTherm 35 has a thermal conductivity of 0.035 W/mK.

Crown FrameTherm Roll 40 has a thermal conductivity of 0.040 W/mK.

Crown FrameTherm Roll 32 has a thermal conductivity of 0.032 W/mK.

Fire performance

Crown FrameTherm 40/35/32, and Crown DriTherm Cavity Slab 37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Building Regulations state that external walls in domestic construction shall achieve half hour fire resistance. In tests and assessments carried out TRADA Technology Ltd in accordance with BS 476: Part 21: 1987, different timber frame external walls incorporating Crown FrameTherm Roll/Slab gave the required fire resistance.

Typical junction with timber ground floor

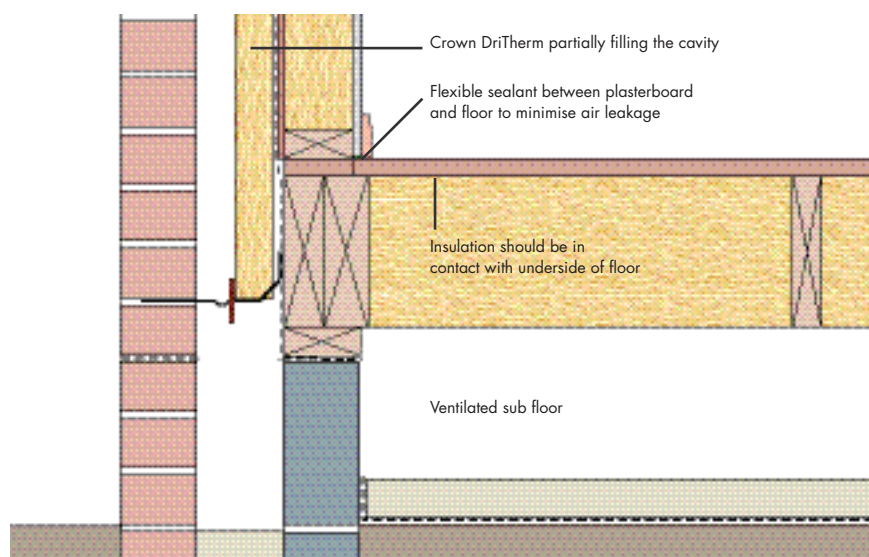


Table 44: Typical U-values for Crown Twin insulated wall – partial fill

Product	U-values (W/m ² K)			
	Thickness (mm)	Crown DriTherm Cavity Slab thickness (mm)	Masonry outer leaf	Low e service duct
Timber studs filled with: Crown FrameTherm 32	140	50	0.19	0.17
	90	50	0.24	0.21
Crown FrameTherm 35	140	50	0.19	0.18
	90	50	0.24	0.22
Crown FrameTherm 40	140	50	0.20	0.19
	90	50	0.26	0.23

Table 45: Typical U-values for Crown Twin insulated wall – full-fill

Product	U-values (W/m ² K)			
	Thickness (mm)	Crown DriTherm Cavity Slab thickness (mm)	Masonry outer leaf	Low e service duct
Timber studs filled with: Crown FrameTherm 32	140	100	0.15	0.14
	90	100	0.19	0.17
Crown FrameTherm 35	140	100	0.16	0.15
	90	100	0.19	0.18
Crown FrameTherm 40	140	100	0.17	0.16
	90	100	0.20	0.18

Notes: The U-values have been calculated to BS EN ISO 6946: 1997 and BR 443. Studs assumed to be 38mm wide at 600mm centres (allowances for sole plates etc, give a 15% proportional area for the timber). Stud depth is taken to be the same as the thickness of insulation specified. Thermal conductivity of timber studs is 0.120 W/mK. Unventilated low emissivity airspace in service void assumed to provide R value of 0.44 m²K/W as specified in BR443. Higher values can be achieved with proprietary products. Please contact Knauf Insulation Technical Advisory Centre for calculations that include specific products.

Typical specification

Twin insulation full-fill system:

External wall panels to be insulated between studs using Crown FrameTherm 40/35/32*mm thick

(*Delete as appropriate)

Insulation to be cut as necessary and friction fitted between studs. The breather membrane stapled*/nailed* to the sheathing and extending below the lowest timber member (*Delete as appropriate).

Cavity formed between internal and external leaves to be fully filled with Crown DriTherm Cavity Slab 37.....mm thick. The lowest run of wall ties to be located at 600mm centres horizontally. Ties thereafter to be at 450mm centres vertically and at 600mm centres horizontally. All work to be in accordance with manufacturers instructions.

Twin insulated part fill system:

Frame and breather membrane as above, then:

Crown DriTherm Cavity Slab 37.....mm thick to be fitted against the breather membrane on the face of the sheathing and held back using insulation retaining clips fixed to the wall ties.

The lowest run of wall ties to be located at 600mm centres horizontally. Ties thereafter to be at 450mm centres vertically and at 600mm centres horizontally. All work to be in accordance with manufacturers instructions.

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



Alternatively, refer to NBS clauses: P10/210, F30/10, 150 and F30/12, 155

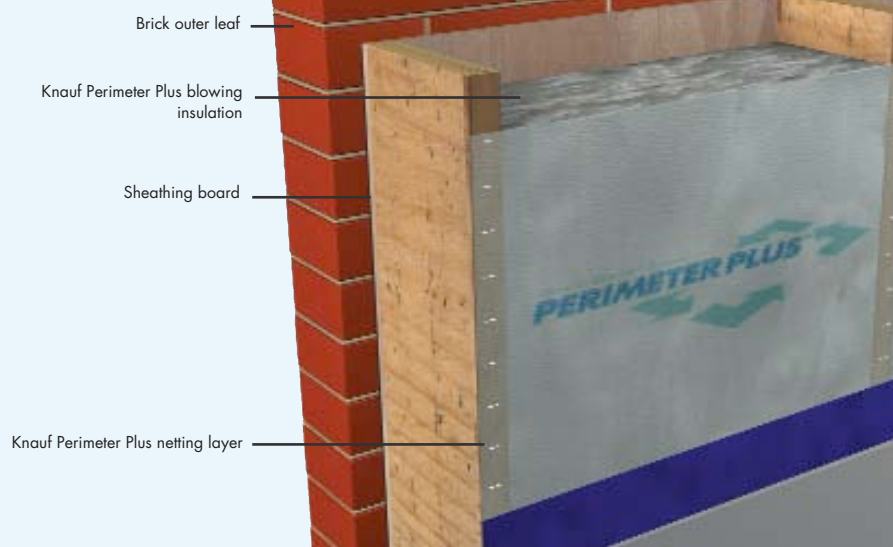
Timber frame walls

Single layer blow-in-insulation blanket system

Advantages

- ✓ Low cost
- ✓ Installed by approved contractor
- ✓ Perimeter Plus is a Zero ODP Zero GWP insulation product
- ✓ The manufacture of Perimeter Plus has a very low impact on the environment

Tf05



Products

Knauf Perimeter Plus™ blowing insulation is an unbonded glass mineral wool which is blown into the cavities between the frame in timber frame construction. It requires no mixing on site and is dry when installed, adding no water to the building. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*.

Knauf Perimeter Plus blowing insulation is the insulation component of the Knauf Perimeter Plus Blow-in-Blanket System. This system is installed by a network of nationwide approved installers. The Blow-in-Blanket system also includes an insulation netting layer that retains the insulation in the frame cavity during the blowing process and before the wall is lined with the vapour control layer and plasterboard.

Crown DriTherm Cavity Slab 32 is a lightweight rigid slab of glass mineral wool with a water repellent additive.

It is manufactured to fit between wall ties at standard spacings. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

* Ecohomes and Code for Sustainable Homes classification

Typical construction

Inner leaf comprising 12.5mm plasterboard, vapour control layer, Knauf Perimeter Plus Blow-in-Blanket System consisting of the Perimeter Plus netting layer and Knauf Perimeter Plus blowing insulation blown between studwork, plywood sheathing and Knauf Breatheline, breathable membrane. A 50mm cavity separates the timber frame from the outer leaf, typically of brick. Other cladding options, such as tile hanging and timber boarding can also be utilised.

Installation

The Perimeter Plus netting layer is stapled across the entire wall area creating discrete cavities of each stud void. A hole is then cut in the netting just large enough to accommodate the nozzle of the Perimeter Plus Blow-in-Blanket System. The nozzle is inserted into the cut and the cavity is filled with Perimeter Plus blowing insulation. The Perimeter Plus Blow-in-Blanket System includes sensors that determine when the cavity has been filled to the required density and cuts off the flow automatically. Continue filling all the cavities until the entire wall area is insulated.

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

Knauf Breatheline or a low emissivity breather membrane should be stapled or nailed to the sheathing board at maximum 500mm centres.

It should be lapped so that each joint is protected, with upper layers lapped over lower layers to shed water away from the sheathing. Horizontal laps should be at least 100mm wide and the membrane should extend below the lowest timber member. Vertical laps should be at least 150mm and be staggered.

Crown DriTherm Cavity Slab 32

Crown DriTherm Cavity Slab 32 can be used within the cavity in the same manner as shown in Tf04, page 594.

U-values for partial fill solutions are shown in Table 47, opposite.

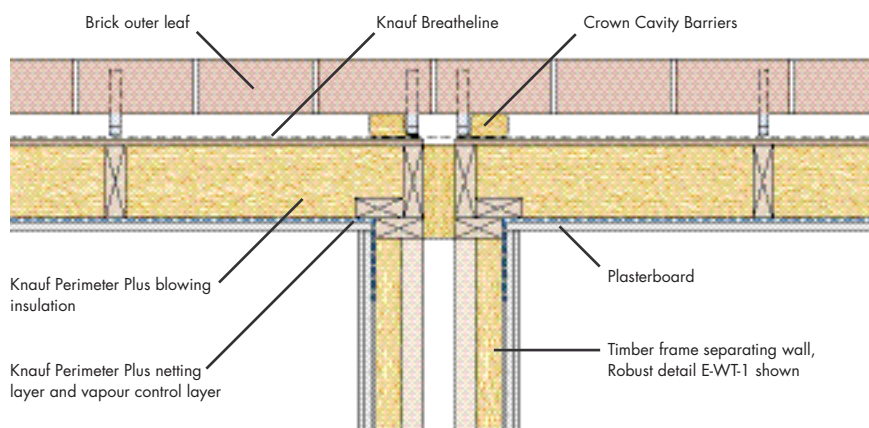


Table 46: Typical U-values for timber frame walls with Perimeter Plus Blow-in-Blanket system

Product	U-values (W/m ² K)			
	Thickness (mm)	Breather membrane	Masonry outer leaf	Tile/timber clad outer leaf
Perimeter Plus	90	Knauf Breatheline	0.38	0.42
	140	Knauf Breatheline	0.27	0.29
	200	Knauf Breatheline	0.21	0.22
	90	Low E	0.34	0.42
	140	Low E	0.25	0.29
	200	Low E	0.20	0.22

Notes: The U-values have been calculated to BS EN ISO 6946: 1997 and BR 443. Studs assumed to be 38mm wide at 600mm centres (allowances for sole plates etc, give a 15% bridging area for the timber). Stud depth is taken to be the same as the thickness of insulation specified. Thermal conductivity of timber studs is 0.120 W/mK. Ventilated low emissivity airspace assumed to increase the R value of the cavity to 0.29 m²K/W and unventilated low emissivity airspace assumed to increase R value of cavity to 0.44 m²K/W as specified in BR443. Higher values can be achieved with proprietary products. Please contact Knauf Insulation Technical Advisory Centre for calculations that include specific products.

Table 47: Partial fill U-values

Product	U-values (W/m ² K)					
	Timber stud (mm)	Crown DriTherm Cavity Slab 32 (mm)	Breather membrane	Service void	Masonry outer leaf	Tile/timber outer leaf
Perimeter Plus	90	50	Knauf Breatheline	n/a	0.23	0.25
		65	Knauf Breatheline	n/a	0.21	0.22
		75	Knauf Breatheline	n/a	0.20	0.21
		85	Knauf Breatheline	n/a	0.19	0.19
	140	50	Knauf Breatheline	n/a	0.19	0.19
		65	Knauf Breatheline	n/a	0.17	0.18
		75	Knauf Breatheline	n/a	0.16	0.17
		85	Knauf Breatheline	n/a	0.15	0.16
	90	50	Knauf Breatheline	Low E	0.21	0.22
		65	Knauf Breatheline	Low E	0.19	0.20
		75	Knauf Breatheline	Low E	0.18	0.19
		85	Knauf Breatheline	Low E	0.17	0.18
140	50	Knauf Breatheline	Low E	0.17	0.18	
	65	Knauf Breatheline	Low E	0.16	0.16	
	75	Knauf Breatheline	Low E	0.15	0.16	
	85	Knauf Breatheline	Low E	0.14	0.15	

Typical specification

External wall panels to be insulated between studs using Knauf Perimeter Plus Blow-in-Blanket System. The breather membrane stapled*/nailed* to the sheathing and extending below the lowest timber member (*Delete as appropriate).

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

All external walls to be insulated during construction by partially filling the cavities with Crown DriTherm Cavity Slab 32mm thick.

The first run of wall ties to be located at 600mm centres horizontally (at a level to be decided 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.

All work under construction must be protected overnight and during adverse weather conditions in accordance with BS 5628: Part 3: 1985.



Alternatively, refer to NBS clause: F30/10,150

Performance

Thermal performance

Knauf Perimeter Plus blowing insulation has a thermal conductivity of 0.034 W/mK.

Crown DriTherm Cavity Slab 32 has a thermal conductivity of 0.032 W/mK.

Table 46 gives U-values for typical prefabricated timber frame walls insulated with the Knauf Perimeter Plus Blow-in-Blanket System.

Table 47 gives U-values for typical prefabricated timber frame walls insulated with the Knauf Perimeter Plus Blow-in-Blanket System and Crown DriTherm Cavity Slab 32.

Fire performance

Knauf Perimeter Plus Blowing Insulation and Crown DriTherm Cavity Slab 32 are classified as Euroclass A1 to BS EN ISO 13501-1.

KNAUFINSULATION



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