



August 2008: Issue 1

Residential Refurbishment 3.2.2 Pitched roofs - rafter level



energy saving



warmth



quietness



fire protection



sustainability

Residential Refurbishment

Pitched Roof - Rafter Level Contents

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Pitched roofs – rafter level

Solution optimiser and pathfinder

Loft or attic conversions cannot be insulated in the same way as a normal loft. With the high levels of thermal performance required by the building regulations it is vitally important that the optimum insulation solution is selected. Rafter depth, the roof pitch and the available thickness of the insulation all need to be taken into account when designing the loft conversion and ultimately when installing the insulation.

Pitched roof in plane of rafters

Construction compatibility with Part L1B

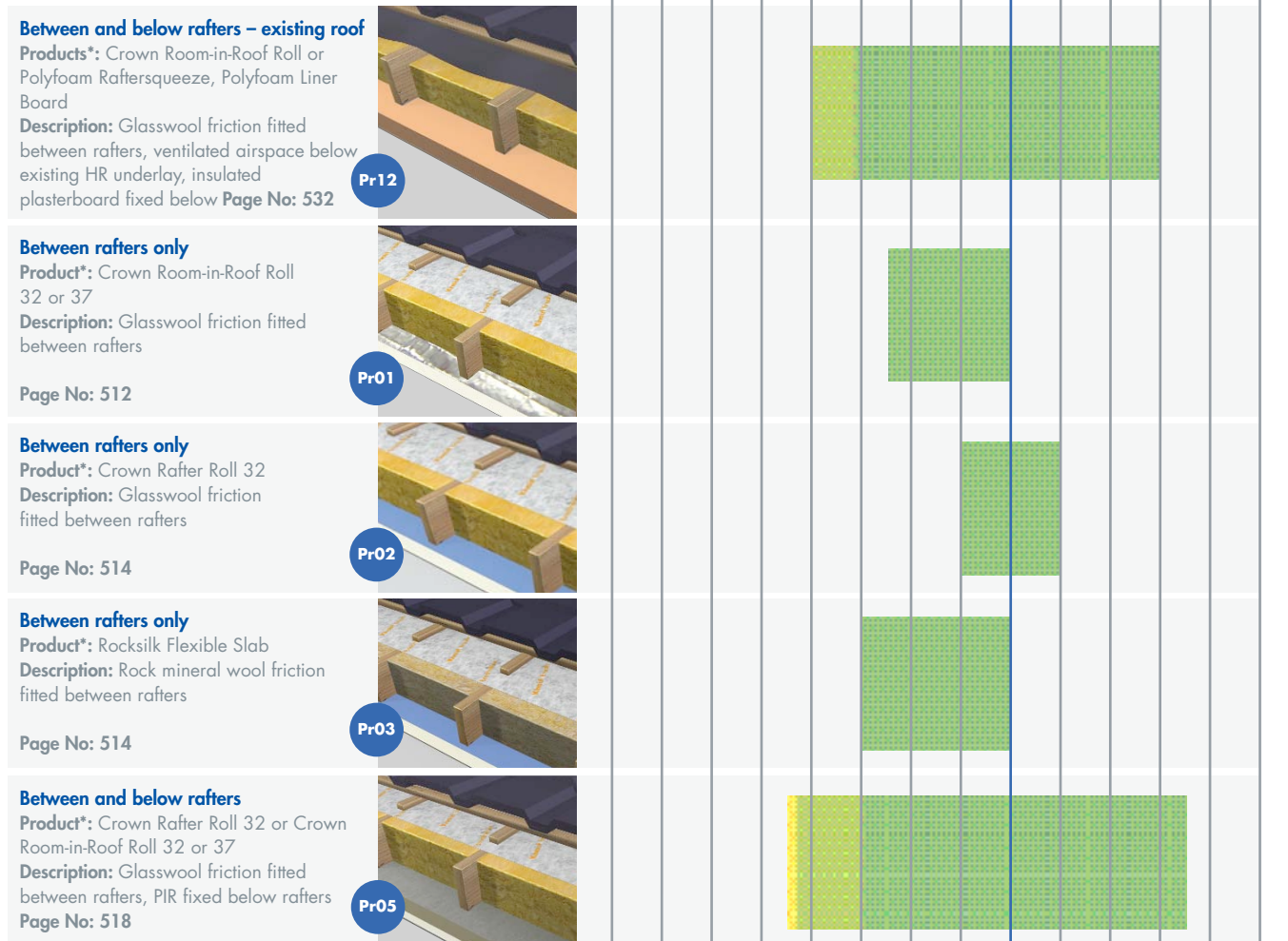
New build extension
and replacement or upgrade
Building Regulations requirement

Elemental U-value requirement

Knauf Insulation solution

U-values

0.36 0.34 0.32 0.30 0.28 0.26 0.24 0.22 0.20 0.18 0.16 0.14 0.12 0.10



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.

Pitched roof in plane of rafters

Construction compatibility with Part L1B

Elemental U-value requirement

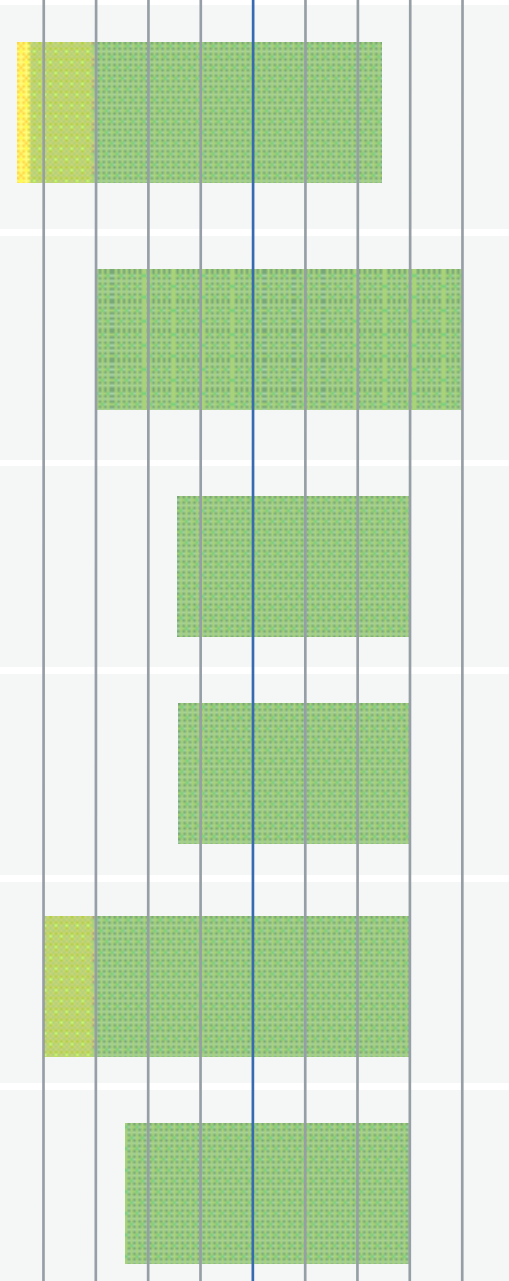
Knauf Insulation solution

U-values

0.36 0.34 0.32 0.30 0.28 0.26 0.24 0.22 0.20 0.18 0.16 0.14 0.12 0.10

*New build extension
and replacement or upgrade
Building Regulations requirement*

<p>Between and below rafters with insulated plasterboard Products*: Crown Room-in-Roof Roll 32 or 37, Polyfoam Liner Board Description: Glasswool friction fitted between rafters, insulated plasterboard fixed below rafters Page No: 520</p>	 <p>Pr06</p>
<p>Between and below rafters with counter battens Product*: Crown Room-in-Roof Roll 32 or 37 (2 layers) Description: Glasswool friction fitted between rafters, counter battens below infilled with glasswool Page No: 522</p>	 <p>Pr07</p>
<p>Between rafters with service duct Product*: Crown Room in Roof Roll 32 or 37 Description: Glasswool friction fitted between rafters, Low E VCL and counter battens creating service duct Page No: 524</p>	 <p>Pr08</p>
<p>Between rafters with Multifoil Products*: Crown Rafter Roll 32 or 37, Thinsulex multifoil/service void Description: Glasswool friction fitted between rafters, Thinsulex Multifoil and counter battens below Page No: 526</p>	 <p>Pr09</p>
<p>Between and above rafters Products*: Polyfoam Pitched Roofboard, Polyfoam Raftersqueeze Description: XPS board over rafters, compressible XPS board friction fitted between rafters Page No: 528</p>	 <p>Pr10</p>
<p>Between and above rafters Products*: RocksilK Krimpac Pitched, Crown Room in Roof Roll 32 or 37 Description: Compression resistant rock mineral wool insulation over rafters, friction fitted glasswool between rafters Page No: 530</p>	 <p>Pr11</p>



Pitched roofs – rafter level

Insulation at rafter level design

Utilising the loft area as a living space

Insulating a loft or an attic at rafter level can create a significant amount of additional space ideal for a loft conversion. A high quality loft conversion has the potential to increase the value of a dwelling and creates more space thus negating the need for a new build extension. Furthermore many loft conversions do not need planning permission however the design of a loft extension must always meet current Building Regulations.

When designing the roof insulation solution, the minimum structural rafter depth, the roof pitch and the thickness of insulation needed to meet the desired thermal performance should be considered.



Rafter level insulation

Insulation between the rafters can be designed in two ways:

- 'Breathing' roof with LR underlay
- Ventilated design with HR underlay

LR roof tile underlays have only been widely available in the UK in the last 10-15 years. Consequently any refurbishment project that does not include the removal of the existing roof covering and roof tile underlay and its replacement with an LR underlay should use a ventilated design, unless it can be confirmed that the roof tile underlay is a type LR. If the insulation installed is to the full depth of the rafter the designer needs to confirm that counter battens are present in the existing roof above the LR underlay so that there is an unobstructed path for wind driven rain or snow to drain to the gutter.



design detail finder

Knauf Insulation solutions for these types of construction can be found on pages 512-539

Rafter level insulation with LR underlay

With this option, insulation fully fills the rafter space without an airspace between the insulation and type LR underlay. Counter-battens are needed to ensure wind driven rain or snow drains freely to the gutter.

The space created by the counter battens allows the dispersion of any moisture that passes through the breather underlay. Where the roof covering is very tight fitting, eaves ventilation above the underlay is recommended. Seek advice from the manufacturer of the roof covering material if in doubt.

A combined airtight/vapour control layer should be placed on the warm side of the insulation. This not only makes the ceiling convection tight, but also restricts the amount of water vapour passing through the ceiling.

Where cables and piped services are to be installed, the plasterboard lining may be battened out to provide a suitable services duct. The services should be routed on the warm side of the vapour control layer to avoid any puncturing.

It would be appropriate to seal the ceiling to the same standard as required where the insulation is installed at the horizontal ceiling level e.g. 'a well sealed ceiling'.

Over rafter insulation with LR underlay

Insulation over the rafters provides a completely insulated external envelope to the roof construction, and allows the maximum usable space within the roof enclosure.

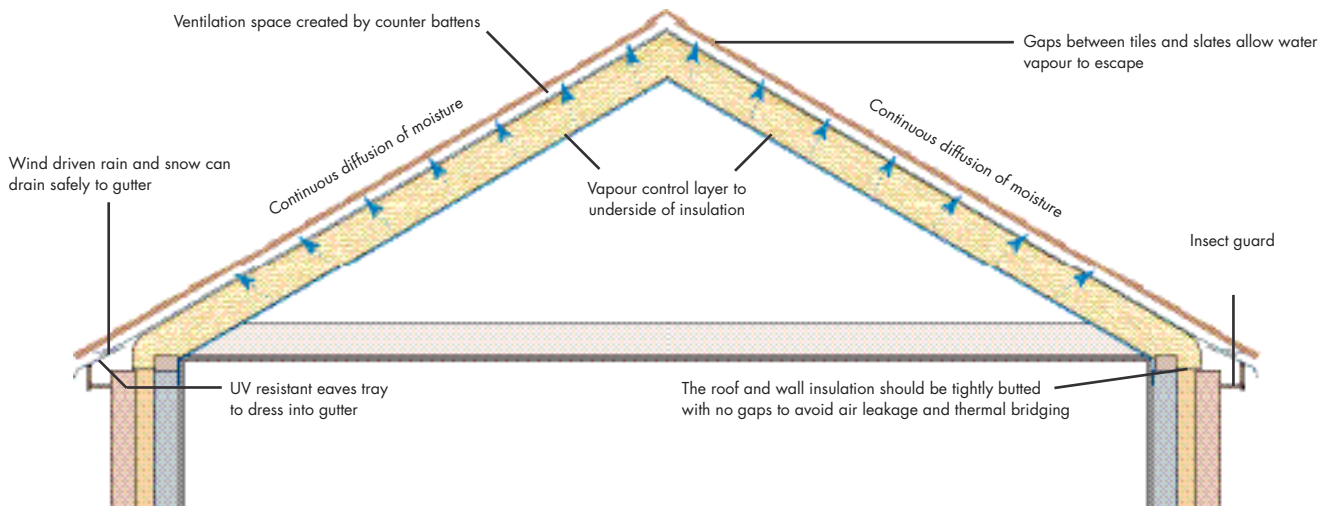
The insulation boards are laid across the rafters. It is important that there should be no gaps in the insulation layer and no ventilation between the outside and the attic space. A LR underlay must be provided to allow moisture vapour to permeate through the roof construction.

Counter battens are fixed through the insulation boards and vapour permeable underlay into the rafters. Where the over rafter insulation is over 50mm thick, consideration should be given to the fixing of the counter battens.

Further insulation is placed between the rafters to achieve the desired insulation performance. If the insulation board over the rafters has a high vapour resistance, the use of mineral wool between the rafters is not recommended unless the designer is confident that an effective vapour control layer can be provided to the underside of the rafters.

The rafters should be faced with 12.5mm plasterboard, or similar, to provide fire protection.

Rafter level insulation with LR underlay



Rafter level insulation with HR underlay

With this design, a 50mm ventilated airspace is required between the top of the insulation and the tiling underlay. Should the rafter depth be insufficient to accommodate both the required thickness of insulation and the 50mm ventilated airspace, an insulation/plasterboard laminate is recommended. This has the added benefit of minimising thermal bridging.

Ventilation openings should be provided at each and every roof void at both low and high level. At the eaves, ventilation openings should be equivalent to a 25mm continuous gap. At the ridge the ventilation opening should be the equivalent of a 5mm continuous gap each side of the ridge.

Care is needed where rooflights and dormer windows interrupt the ventilation path. Ventilation to the outside must be provided at the top and bottom of each space between the rafters.

It is usual for the HR underlay to drape between the rafters to avoid the need for counter battens.

A vapour control layer must be applied to the warm side of the insulation.

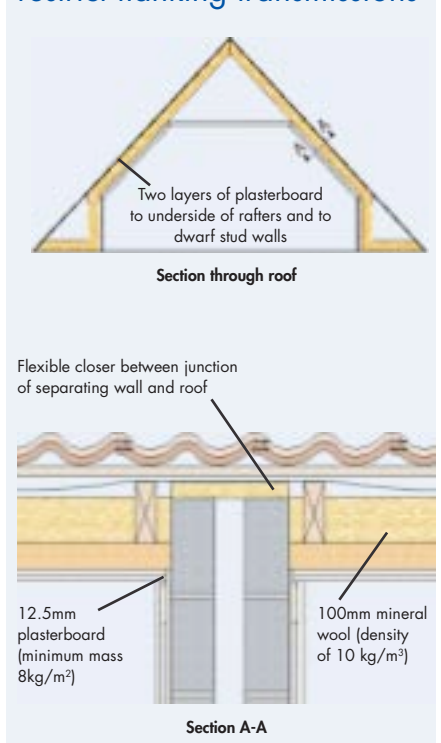
Flanking sound

Roofs that are insulated between rafters and adjoin masonry separating walls can act as a flanking path for sound transmissions from one dwelling to another. Using glass or rock mineral wool insulation will restrict the passage of sound into the roof structure minimising flanking transmissions.

The excellent acoustic properties of mineral wool are also beneficial at rafter level in reducing the noise from road traffic and air planes as well as rainfall drumming on the roof.

The ceiling and dwarf walls should be lined with two layers of plasterboard with a combined minimum mass of 16 kg/m². Normally this would be achieved using two layers of 12.5mm plasterboard, but could also be achieved using a layer of 9.5mm plasterboard plus a layer of 15mm plasterboard.

Room-in-roof constructions to restrict flanking transmissions



Pitched roofs – rafter level

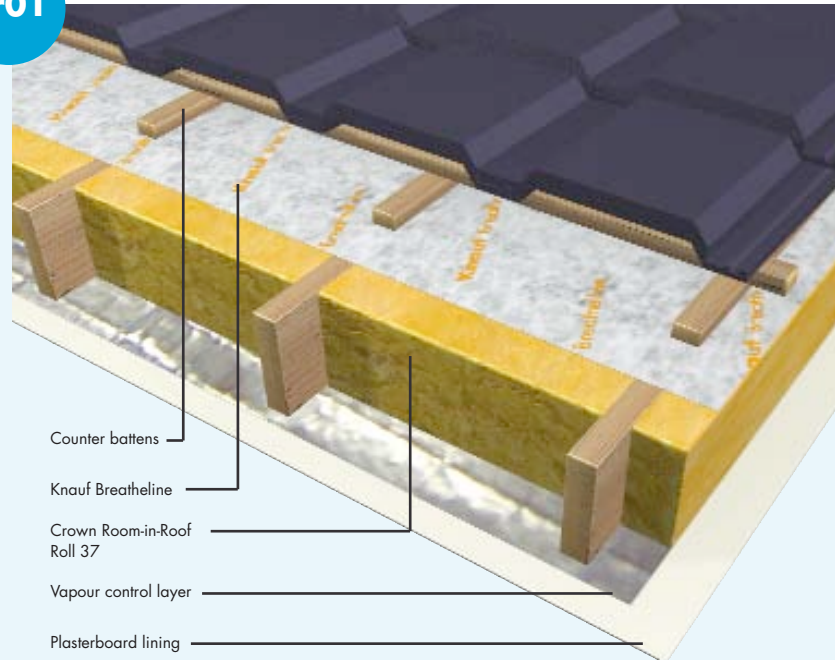
Between rafters only



Pr01

Advantages

- ✓ Uses void in structure as insulation zone
- ✓ Semi-rigid mineral wool products can be friction fitted with no special fixings, speeding up installation
- ✓ Simple installation from within sealed roof
- ✓ Utilises Euroclass A1 insulation throughout
- ✓ Using Crown Room-in-Roof Roll 37 will significantly improve the acoustic performance of the roof – reducing airborne noise
- ✓ Crown Room-in-Roof Roll 37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Low cost option
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient and non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. 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

Robust Details

In order to comply with the Robust Details requirements for masonry separating walls and roof junctions, the complete ceiling area should contain at least 100mm of mineral wool (10 kg/m³ min) between the rafters and installed so that it is flush with the soffit of the rafters. Any dwarf walls which are adjacent to the separating wall where there are rooms in the roof should also contain at least 100mm of mineral wool (10 kg/m³ min).

Introduction

The most satisfactory method of insulating at pitch level within a roof is when the required thermal performance can be achieved within the depth of the rafters. This is because it does not increase the depth of the roof build up, special fixings are not required and all insulation work can be carried out from within the sealed roof space.

Typical construction

A pitched roof of timber rafters with tiles or slates on battens and counter battens on Knauf Breatheline. The space between the rafters is fully insulated with Crown Room-in-Roof Roll 37.

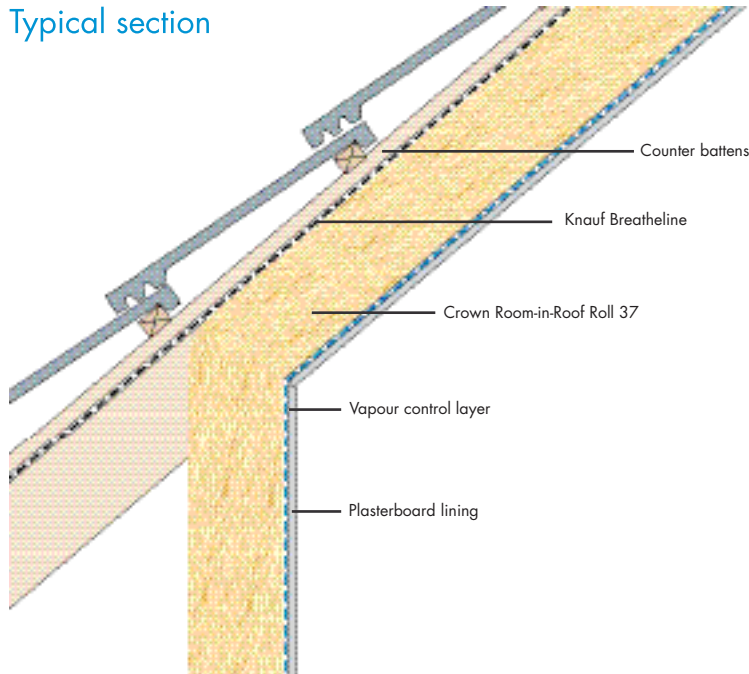
Installation

Knauf Breatheline is pulled taut and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter. Alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed to the manufacturer's recommendations.

Crown Room-in-Roof Roll 37 is simply friction fitted to fully fill the space between the rafters, with all joints closed, and is normally fitted from below once the roof is weathertight.

The roof insulation should be cut to shape to link with the wall insulation to avoid a thermal bridge at the eaves.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Room-in-Roof Roll 37...mm thick, friction fitted between the rafters. The insulation to be pushed over the wall plate at the eaves to link up with the wall insulation.



Alternatively, refer to NBS clauses: P10/140 and 320

Performance

Thermal performance

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Table 7 gives U-values for typical constructions with insulation between the rafters.

Fire performance

Crown Room-in-Roof Roll 37 is classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-values achieved are as shown in Table 7.

Table 7: Typical U-values of roofs with insulation between rafters

Product	Thickness (mm)	U-values (W/m ² K)
Crown Room-in-Roof Roll 37	200	0.20
	160	0.25

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Pitched roofs – rafter level

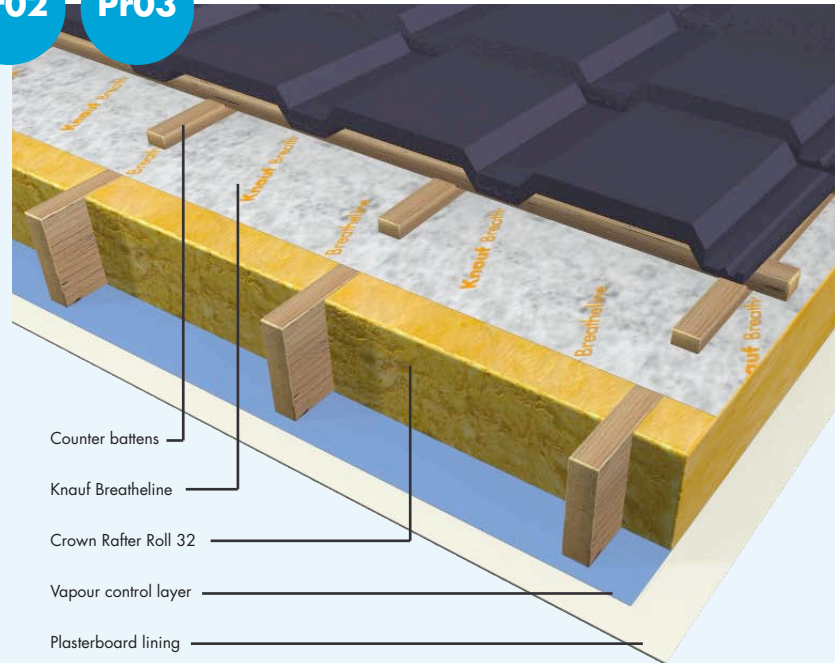
Between rafters only



Advantages

- ✓ Uses void in structure as insulation zone
- ✓ Mineral wool products can be friction fitted with no special fixings, speeding up installation
- ✓ Simple installation from within sealed roof
- ✓ Utilises Euroclass A1 insulation throughout
- ✓ Using Crown Rafter Roll 32 will significantly improve the acoustic performance of the roof – reducing airborne noise
- ✓ Crown Rafter Roll 32 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls.
- ✓ Long rolls with greater coverage per roll than other equivalent products

Pr02 Pr03



Products

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. 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 – see also page 534.

Rocksilk Flexible Slab is a semi-rigid rock mineral wool slab. In this construction Rocksilk Flexible Slab can be used as an alternative to Crown Rafter Roll 32. See Table 9.

* Ecohomes and Code for Sustainable Homes classification

Robust Details

In order to comply with the Robust Details requirements for masonry separating walls and roof junctions, the complete ceiling area should contain at least 100mm of mineral wool (10 kg/m³ min) between the rafters and installed so that it is flush with the soffit of the rafters. Any dwarf walls which are adjacent to the separating wall where there are rooms in the roof should also contain at least 100mm of mineral wool (10 kg/m³ min).

Introduction

The most satisfactory method of insulating at pitch level in a roof is when the required thermal performance can be achieved within the depth of the rafters. This is because it does not increase the depth of the roof build up, special fixings are not required and all insulation work can be carried out from within the sealed roof space.

Typical construction

A pitched roof of timber rafters with tiles or slates on battens and counter battens on Knauf Breatheline. The space between the rafters is fully insulated with Crown Rafter Roll 32.

Installation

Knauf Breatheline is pulled taut and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter.

Alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed to the manufacturer's recommendations.

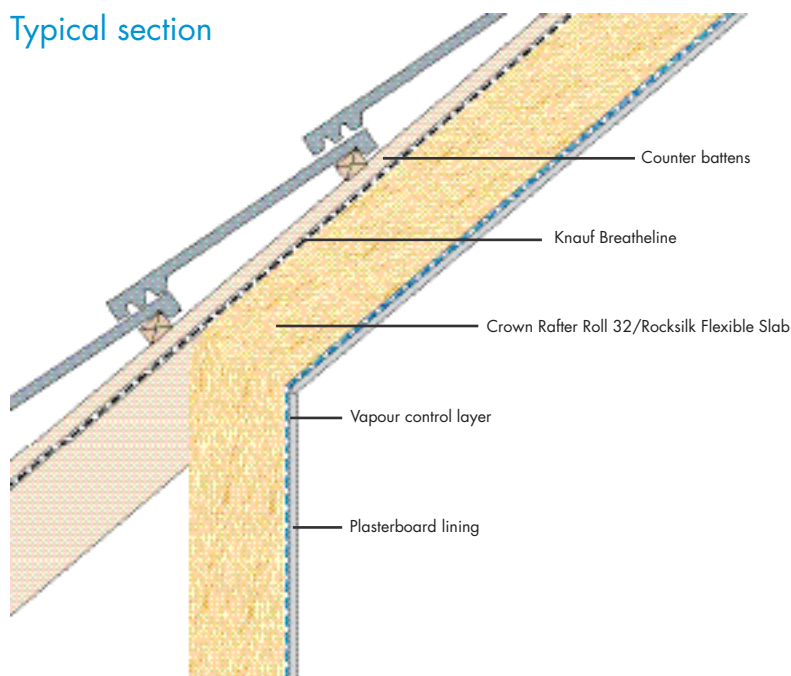
Crown Rafter Roll 32 is simply friction fitted (in layers if necessary) to fully fill the space between the rafters. All layers should be closely butt jointed, and are usually installed from below once the roof is weathertight.

If installed in layers, ensure joints are staggered.

The roof insulation should be cut to shape to link with the wall insulation to avoid a thermal bridge at the eaves.

A continuous vapour control layer should be fixed to the underside of the rafters with all joints sealed.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32/Rocksilk Flexible Slab*...mm thick, friction fitted between the rafters. The insulation to be pushed over the wall plate at the eaves to link up with the wall insulation.

(*Delete as appropriate)



Alternatively, refer to NBS clauses: P10/140 and 320

Performance

Thermal performance

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

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

Tables 8 and 9 give U-values for typical constructions with insulation between the rafters.

Fire performance

Crown Rafter Roll 32 and Rocksilk Flexible Slab are classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-values achieved are as shown in Tables 8 and 9.

Table 8: Typical U-values of roofs with insulation between rafters

Pr02	Product	Thickness	U-values
		(mm)	(W/m ² K)
	Crown Rafter Roll 32	200 (100+100)	0.18
		185 (100+85)	0.19
		175 (100+75)	0.20
		165 (100+65)	0.22

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Table 9: Typical U-values of roofs with insulation between rafters

Pr03	Product	Thickness	U-values
		(mm)	(W/m ² K)
	Rocksilk Flexible Slab	200 (2x100)	0.20
		190 (100+90)	0.21
		180 (2x90)	0.22
		170 (100+70)	0.23
		160 (90+70)	0.25
		150 (90+60)	0.26

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Pitched roofs – rafter level

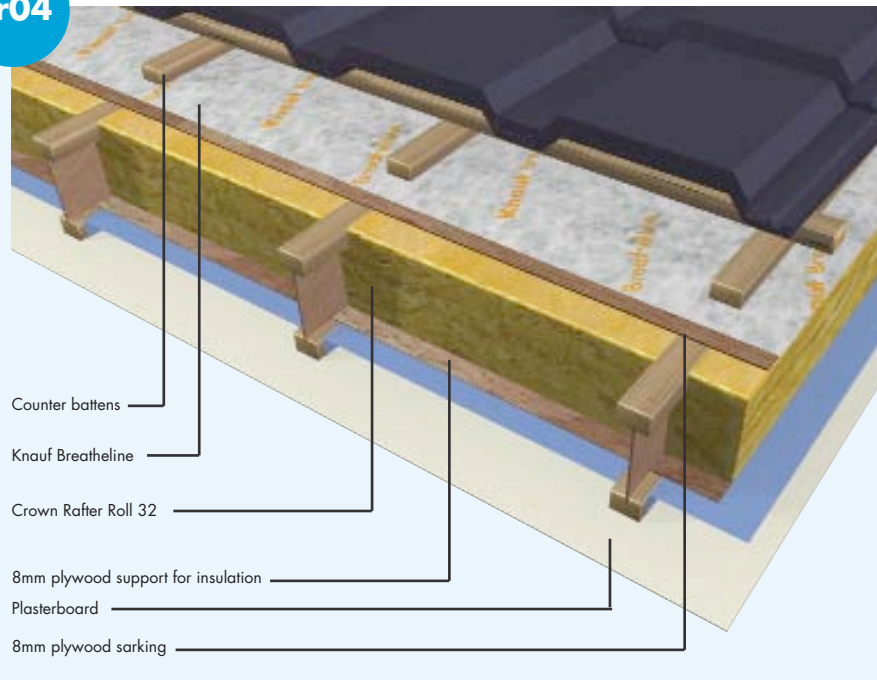
Between engineered timber rafters



Pr04

Advantages

- ✓ Makes excellent use of the deep rafter depth
- ✓ Using Crown Rafter Roll 32 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Rafter Roll 32 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls



Products

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. 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 – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of engineered timber rafters with tiles or slates on battens. 8mm plywood sarking fixed to the top of the rafters with Knauf Breatheline laid across the plywood. Insulated with Crown Rafter Roll 32 between the rafters supported by plywood fixed to the upper edge of the lower flange of the engineered timber rafter and lined internally with a vapour control layer and plasterboard.

Installation

The insulation is fitted from above or below once the roof is watertight.

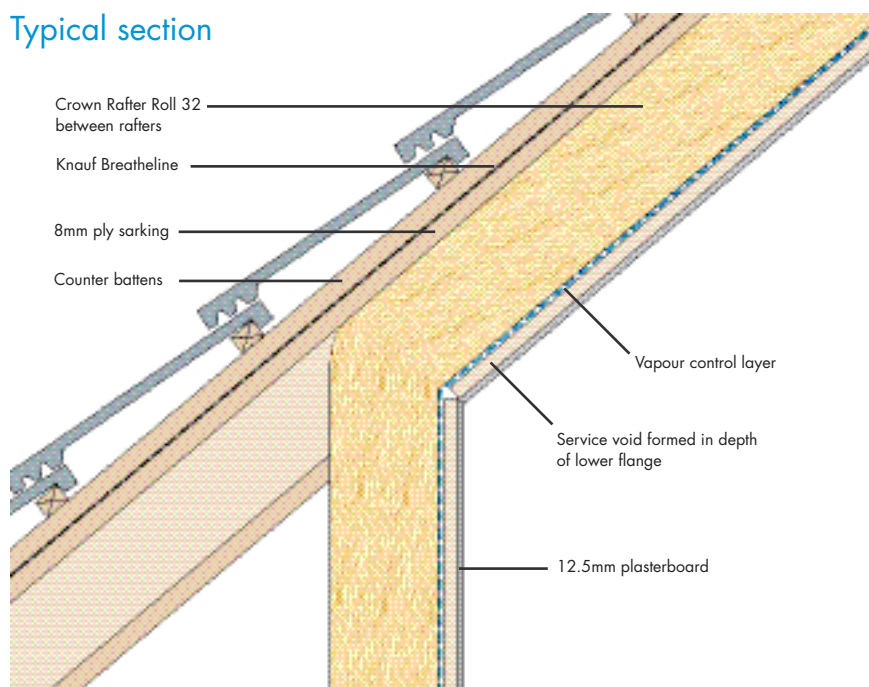
If fitting from above fix the plywood support pieces to the upper edge of the lower flange of the engineered timber rafter making sure the timber fits tightly to the sides of the web of the rafters. Friction fit Crown Rafter Roll 32 between the web and upper flange of the engineered timber rafter to the full depth, in layers if necessary. The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging.

Fix the 8mm plywood sarking board to the top of the rafters. Knauf Breatheline is laid directly over the plywood sarking board and 50x32mm counter battens placed on top of the Knauf Breatheline directly above the rafters and nailed into the rafters with minimum penetration of 38mm into the rafter – alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens and the roofing tiles or slates are fixed to the manufacturer's recommendations.

Install the vapour control layer to the lower face of the plywood support pieces and across the lower edge of each engineered timber flange taping all joints to ensure its integrity is maintained. After first fix services have been installed finish using standard drylining techniques.

If the insulation is fitted from below then the plywood sarking board, Knauf Breatheline, counter battens, tiling battens and slates or tiles are fixed as above. Friction fit Crown Rafter Roll 32 (in layers if necessary) between the rafters. The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging. Install the insulation support pieces and fix the vapour control layer to the lower face of the plywood support pieces and across the lower edge of each engineered timber flange taping all joints to ensure its integrity is maintained. After first fix services have been installed finish using standard drylining techniques.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32, of thickness mm friction fitted between the engineered rafters. The width of the insulation should be appropriate to the spacing of the rafters.

Staple a vapour control layer to the underside of the rafters and seal all joints.

Nail 50x25mm timber battens to the rafters to form a service void. Nail foil backed plasterboard to the timber battens.



Alternatively, refer to NBS clauses.

Performance

Thermal performance

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

Table 10 gives U-values for typical constructions with insulation between the rafters.

Acoustic performance

Crown Rafter Roll 32 meets the specification for a mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Fire performance

Crown Rafter Roll 32 is classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Table 10: Typical U-values for roofs with Crown Rafter Roll 32 between engineered rafters

Product	Insulation Thickness (mm)	U-values (W/m ² K)	
		Service void	Low E service void
Crown Rafter Roll 32	200 (2x100)	0.16	0.15

Note: Rafters assumed to be 58mm wide, 241mm deep with 9.5mm web, spaced at 600 centres, with no bracing between the rafters. The U-values have been calculated in accordance with BS EN ISO 6946: 1997

Pitched roofs – rafter level

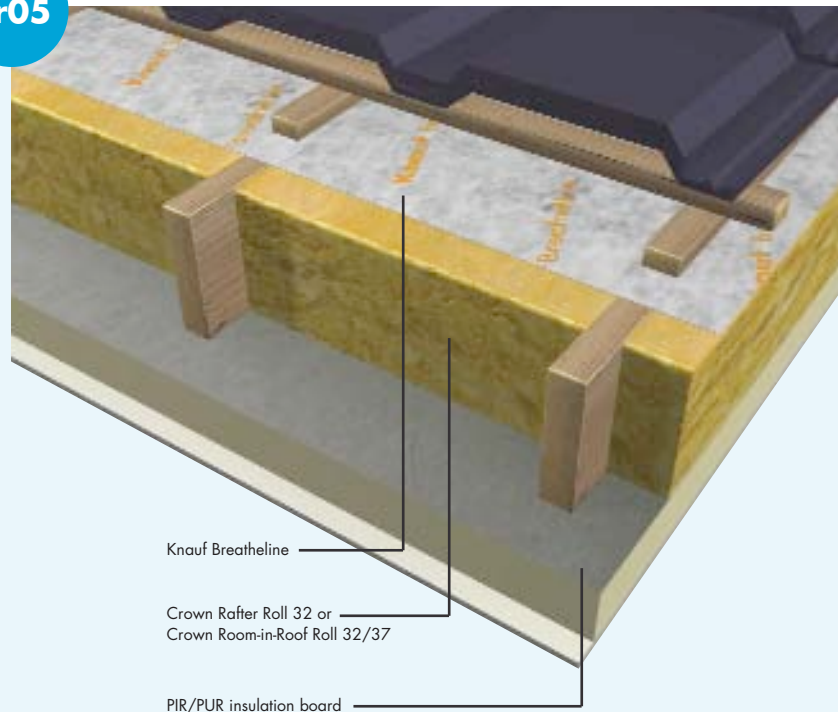
Between and below rafters



Pr05

Advantages

- ✓ System achieves low U-value even with shallow rafters
- ✓ Crown Rafter Roll 32 or Crown Room-in-Roof Roll 32/37 are compressible so it is easy to friction fit the product tight to the sides of rafters ensuring that there is no cold air penetration at junction between the insulation and rafters
- ✓ Using Crown Rafter Roll 32 or Crown Room-in-Roof Roll 32/37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Rafter Roll 32 or Crown Room-in-Roof Roll 32/37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls



Products

Crown Room-in-Roof Roll 32/37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Their manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible - 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 – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters with tiles or slates on battens. Either with counter battens if Knauf Breatheline is pulled taut and insulation is to the full depth of the rafters,

or alternatively without counter battens if it is draped and the insulation stops at least 10mm below the top of the rafters. Insulated with Crown Rafter Roll 32 or Crown Room-in-Roof Roll 32/37 between the rafters and lined internally with rigid foam insulation board.

Installation

Knauf Breatheline is pulled taut and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter - alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed, to the manufacturer's recommendations. Friction fit Crown Rafter Roll 32 or Crown Room-in-Roof Roll 32/37 between the rafters. The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging.

Finally, the PIR/PUR plasterboard laminate is nailed or screwed to the underside of the rafters at maximum 300mm centres at least 12mm in from the board edge.

The fixings should be long enough to penetrate at least 25mm into the timber. The boards are finished using standard drylining techniques.

With service void

Where a service void is provided, nail a foil faced PIR/PUR board to the rafters and tape all the board joints and joints where the board abuts walls, roof windows and other intrusions with self-adhesive aluminised tape to complete the vapour control layer. The vapour control layer formed by the PIR/PUR insulation board and the tape should form a complete, unbroken, barrier to the warm side of the insulation. The vapour control layer should be linked to the air barrier in the external walls

Nail 50mm wide timber battens through the PIR/PUR board into the rafters. The battens to be a minimum of 25mm deep but to suit the required depth of the service void. After installing first fix services, nail plasterboard to the timber battens. The boards are finished using standard drylining techniques.

Performance

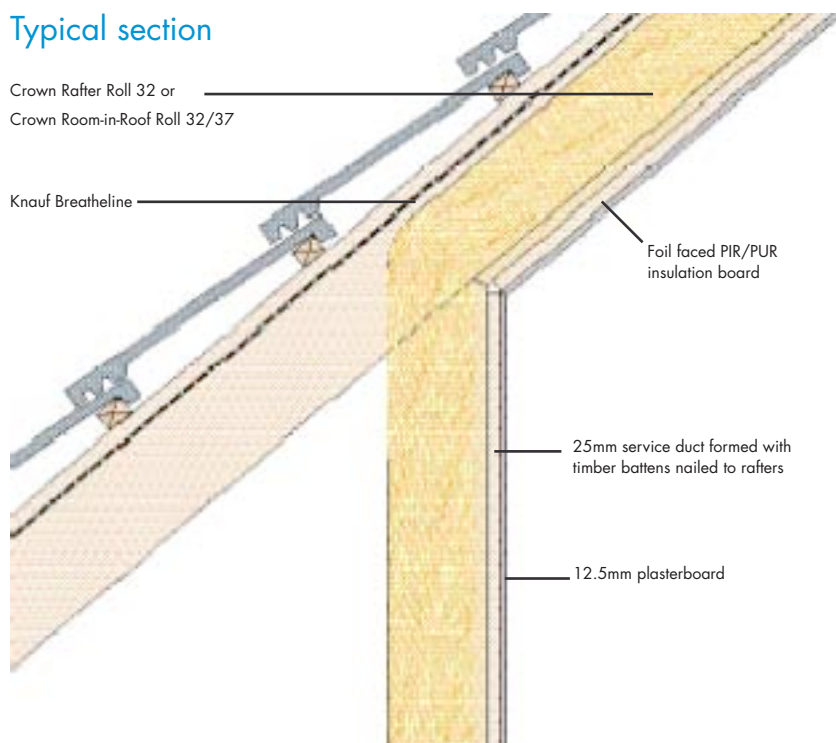
Thermal performance

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

Crown Room-in-Roof Roll 32 has a thermal conductivity of 0.032 W/mK.

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37*, friction fitted between the rafters. The width of the insulation should be appropriate to the spacing of the rafters.

(*Delete as appropriate)

PIR/PUR plasterboard laminate of thicknessmm with integral 12.5mm plasterboard nailed or screwed to the rafters at maximum 300mm centres and finished using standard drylining techniques.



Alternatively, refer to NBS clauses.

The PIR/PUR is assumed to have a thermal conductivity of 0.023 W/mK.

Table 11 gives U-values for typical constructions with insulation between and below the rafters.

Acoustic performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 meet the specification for a mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Fire performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-values achieved are as shown in Table 11.

Table 11: Typical U-values with insulation between and below rafters

Thickness (mm)	U-values (W/m ² K)					
	PIR/PUR Insulation Board thickness (mm)			25mm services void with PIR/PUR Insulation Board, thickness (mm)		
	20	30	40	20	30	40
Crown Room-in-Roof Roll 32						
100	0.26	0.23	0.21	0.24	0.22	0.20
Crown Room-in-Roof Roll 37						
200	0.17	0.16	0.15	0.16	0.15	0.14
160	0.20	0.19	0.17	0.19	0.17	0.16
100	0.28	0.25	0.23	0.26	0.23	0.21
Crown Rafter Roll 32						
200 (2x100)	0.15	0.14	0.13	0.15	0.14	0.13
170 (2x85)	0.17	0.16	0.15	0.16	0.15	0.14
150 (2x75)	0.19	0.18	0.16	0.18	0.17	0.16
130 (2x65)	0.21	0.20	0.19	0.20	0.18	0.17
100	0.26	0.23	0.21	0.24	0.21	0.20
85	0.29	0.26	0.23	0.26	0.23	0.21

Notes: Rafters assumed to be 38mm wide at 600mm centres (6.3% bridging). The U-values have been calculated in accordance with BS EN ISO 6946:1997 and BR443. The service void is assumed to have an R value of 0.34 m²K/W as is specified in BR443. The U-values are valid for service voids at least 25mm deep

Pitched roofs – rafter level

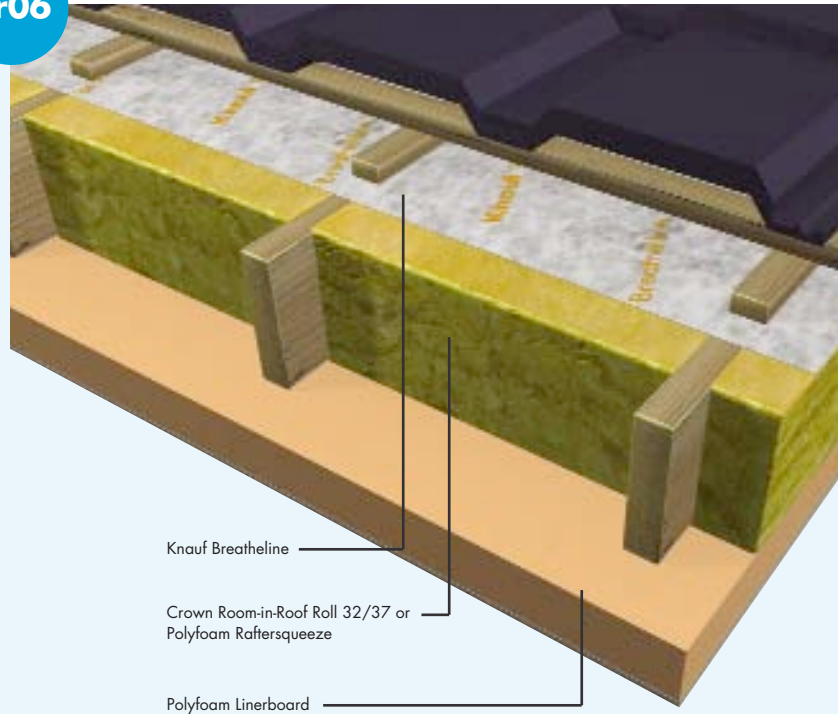
Between and below rafters with insulated plasterboard



Pr06

Advantages

- ✓ System achieves low U-value even with shallow rafters
- ✓ Can be used with taught or draped LR underlay
- ✓ Polyfoam Linerboard provides thermal and lining functions in one application
- ✓ Robust nature of Polyfoam in Polyfoam Linerboard supports the plasterboard, improving its impact resistance
- ✓ Using Crown Room-in-Roof Roll 32/37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Room-in-Roof Roll 32/37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 32/37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Polyfoam Raftersqueeze is 100% ozone friendly, extruded polystyrene insulation. It consists of a flexible infill piece of insulation that fits between rafters, and allows for some timber variation.

Polyfoam Linerboard is a laminate of Polyfoam extruded polystyrene and 9.5mm tapered edge plasterboard.

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters with tiles or slates on battens. Either with counter battens and insulation is to the full depth of the rafters or without counter battens if it is draped and the insulation stops at least a 10mm below the top of the rafters. Insulated with Crown Room-in-Roof Roll 32/37 or Polyfoam Raftersqueeze between the rafters and lined internally with Polyfoam Linerboard.

Installation

Knauf Breatheline is pulled taught and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter. Alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed, to the manufacturer's recommendations. The insulation is fitted from below once the roof is weathertight.

Crown Room-in-Roof Roll 32/37 or Polyfoam Raftersqueeze are friction fitted (in layers if necessary) between the rafters. They should be butt jointed and continuous with the wall insulation to avoid thermal bridging.

Finally, Polyfoam Linerboard is nailed or screwed to the underside of the rafters at maximum 300mm centres at least 12mm in from the board edge. The fixings should be long enough to penetrate at least 25mm into the timber. The boards are finished using standard drylining techniques.

Performance

Thermal performance

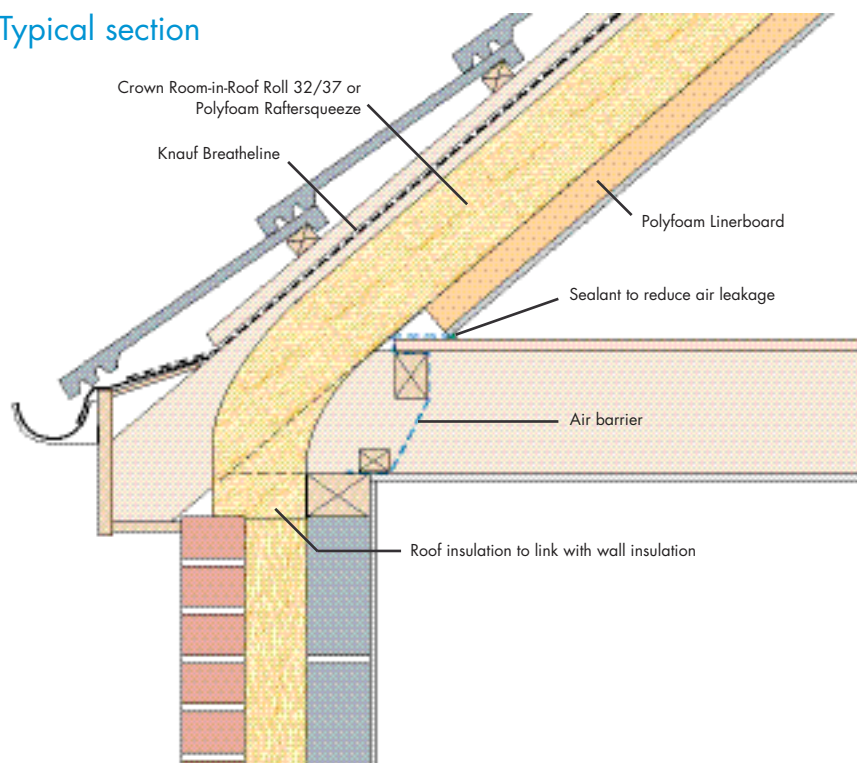
Crown Room-in-Roof Roll 32 has a thermal conductivity of 0.032 W/mK.

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Polyfoam Raftersqueeze and the insulation in Polyfoam Linerboard has a thermal conductivity of 0.030 W/mK.

Table 12 gives U-values for typical constructions with insulation between and below the rafters.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Room-in-Roof Roll 32/37* / Polyfoam Raftersqueezemm thick, friction fitted between the rafters. The width of the insulation should be appropriate to the spacing of the rafters.

(*Delete as appropriate)

Polyfoam Linerboard of thicknessmm with integral 9.5mm plasterboard nailed or screwed to the rafters at maximum 300mm centres and finished using standard drylining techniques.



Alternatively, refer to NBS clauses: P10/140 and 320, and K10/245

Acoustic performance

Crown Room-in-Roof Roll 32/37 meets the specification for a mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Compression resistance

The rigidity of the Polyfoam in Polyfoam Linerboard offers an excellent support to the finished internal lining and assists in the resistance of impact, helping to prolong its service life.

Fire performance

Crown Room-in-Roof Roll 32/37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Polyfoam insulation contains a flame retardant specifically designed to inhibit localised ignition. The boards will melt if brought into contact with high temperature sources. However, the use of the boards will not affect the fire rating obtained by tiled roofs when evaluated by assessment or tested to BS 476: Part 3: 2004.

Polyfoam Linerboard is faced with 9.5mm plasterboard which offers excellent fire performance.

Table 12: Typical U-values of roofs with insulation between and below rafters

Product	Thickness (mm)	U-values (W/m ² K) Polyfoam Linerboard Thickness (mm)		
		25.5/9.5	36/9.5	45.5/9.5
Crown Room-in-Roof Roll 32	100	0.26	0.24	0.22
Crown Room-in-Roof Roll 37	200	0.17	0.16	0.15
	160	0.20	0.19	0.18
	100	0.29	0.26	0.24
Polyfoam Raftersqueeze	150 (2x75)	0.19	0.17	0.17
	140 (65+75)	0.20	0.18	0.17
	125 (50+75)	0.21	0.20	0.19
	100 (2x50)	0.25	0.23	0.22

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Pitched roofs – rafter level

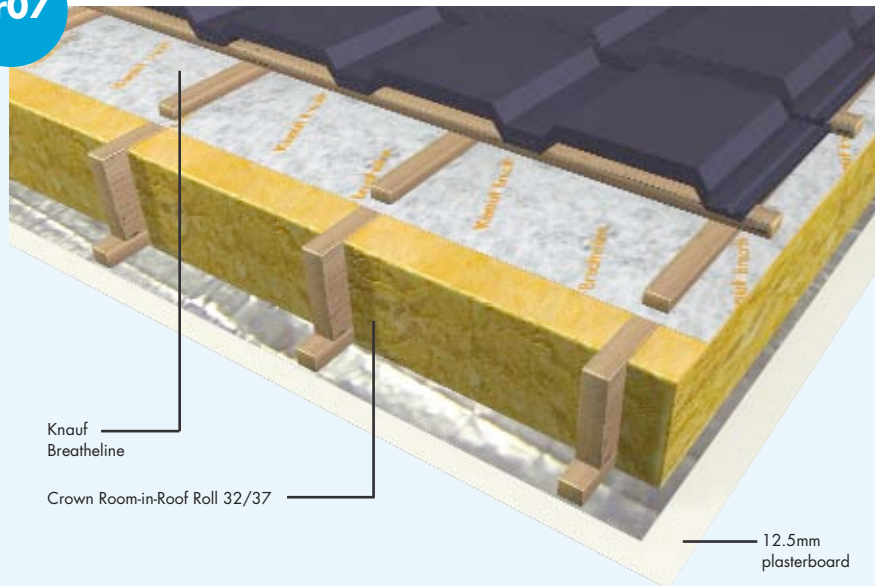
Between and below rafters with counter battens



Pr07

Advantages

- ✓ Can be used with taught or draped LR underlay
- ✓ Using Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 32/37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Their manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. 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 – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters set out at 600mm centres with tiles or slates on battens. Either with counter battens if Knauf Breatheline is pulled taught and insulation is to the full depth of the rafters or without counter battens if it is draped and the insulation stops at least

10mm below the top of the rafters. Insulated with Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 between the rafters. A layer of Crown Rafter Roll 32 is installed above the Crown Room in Roll 32/37 if required and 12.5mm plasterboard forms the internal lining. This is an ideal solution where the depth of shallow rafters can be increased to accommodate an increased thickness of insulation.

Installation

Knauf Breatheline is pulled taught and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter.

Alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed, to the manufacturer's recommendations.

Friction fit, if required, a layer of Crown Rafter Roll 32 into the rafter space leaving sufficient depth to accommodate the Crown Room-in-Roof Roll 32/37 when this is installed between the rafters. The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging. Staple the laps of the integral vapour control layer to the underside of the

rafters and to any dwarf walls. Lap all joints in the vapour control layer. Using a self adhesive aluminised tape seal all joints and staple punctures in the air barrier; junctions between the air barrier and any walls abutting the roof and any penetrations through the roof, such as roof windows. The vapour control layer should be linked to the air barrier in the external walls. Nail plasterboard to the rafters and finish using standard drylining techniques.

Performance

Thermal performance

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

Crown Room-in-Roof Roll 32 has a thermal conductivity of 0.032 W/mK.

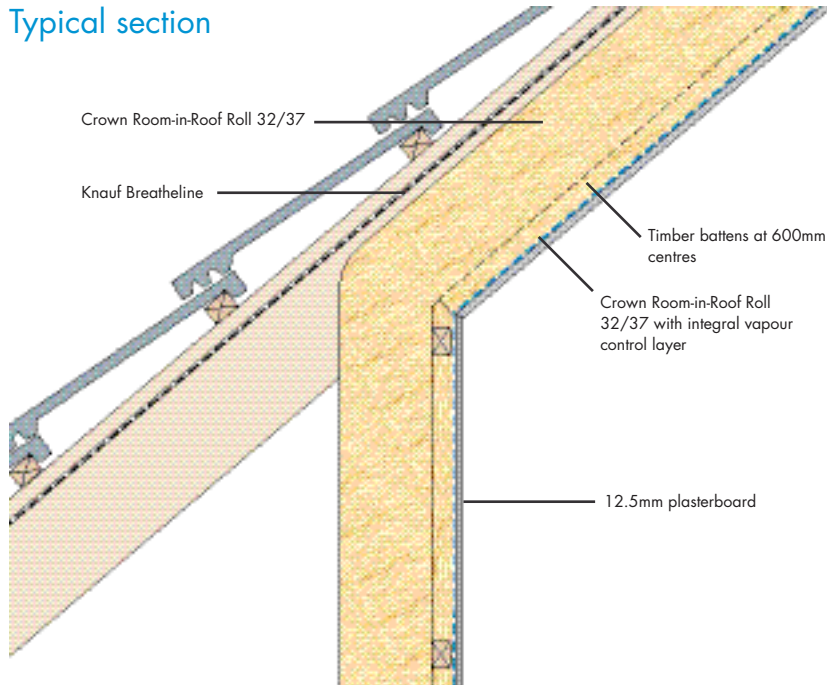
Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Table 14 gives U-values for typical constructions with insulation between the rafters.

Acoustic performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 meet the specification for mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37*, friction fitted between the rafters. The width of the insulation should be appropriate to the spacing of the rafters.

Timber battens to be nailed to the underside of the rafters. A vapour control layer to be stapled to the timber battens.

(*Delete as appropriate)

12.5mm plasterboard nailed or screwed to the timber battens at maximum 300mm centres and finished using standard drylining techniques.

Alternatively, refer to NBS clauses.

Fire performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

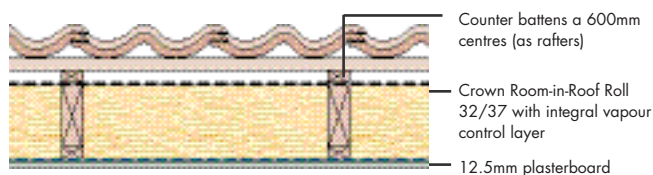
This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-value achieved is as shown in Table 13.

Table 13: Typical U-values of roofs with insulation between rafters and battens

Product	Thickness	U-values (W/m ² K)				
Between rafters		Crown Rafter Roll 32				
	(mm)	50	65	75	85	100
Crown Room-in-Roof Roll 32	100	0.24	0.21	0.20	0.19	0.17
		Crown Rafter Roll 32				
	(mm)	50	65	75	85	100
Crown Room-in-Roof Roll 37	200	0.16	0.15	0.14	0.13	0.12
	160	0.19	0.17	0.16	0.15	0.15
	100	0.26	0.22	0.21	0.20	0.18

Rafters assumed to be 38mm wide at 600mm centres (6.3% bridging). The U-values have been calculated in accordance with BS EN ISO 6946:1997.



Pitched roofs – rafter level

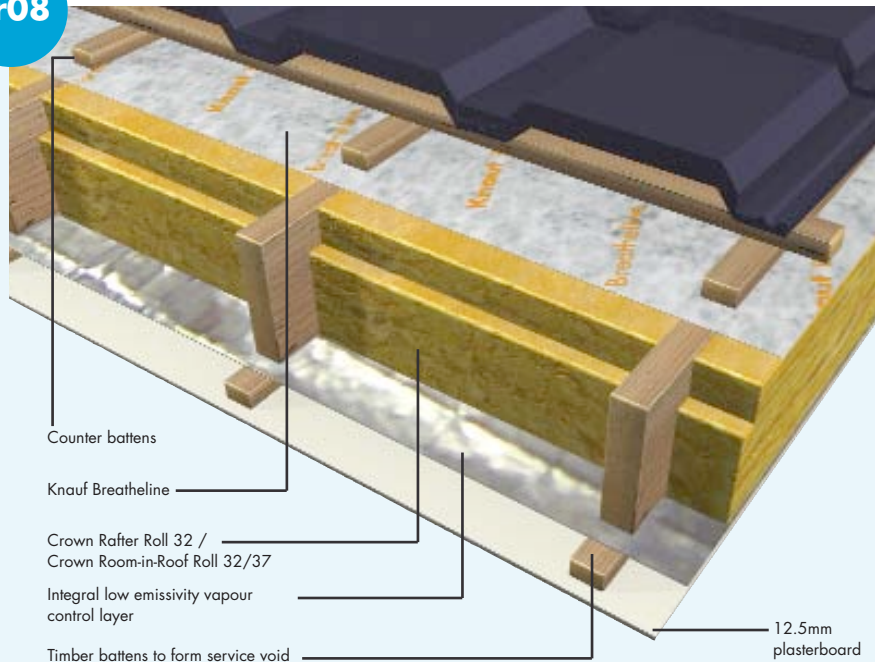
Between rafters with service void



Pr08

Advantages

- ✓ Can be used with taught or draped LR underlay
- ✓ Using Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Using a low emissivity vapour control layer increases the thermal resistance of the service void, thus improving the U-value of the construction



Products

Crown Room-in-Roof Roll 32/37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Their manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. 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 – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters set out at 600mm centres with tiles or slates on battens. Either with counter battens if Knauf Breatheline is pulled taught and insulation is to the full depth of the rafters or without counter battens if it is draped and the insulation stops at least 10mm below the top of the rafters. Insulated with Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 between the rafters. A layer of Crown Rafter Roll 32 is installed above the Crown Room in Roll if required. The integral low emissivity vapour control layer has laps that fix to the rafter and face onto a services void formed with timber battens nailed along the line of the rafters. 12.5mm plasterboard forms the internal lining.

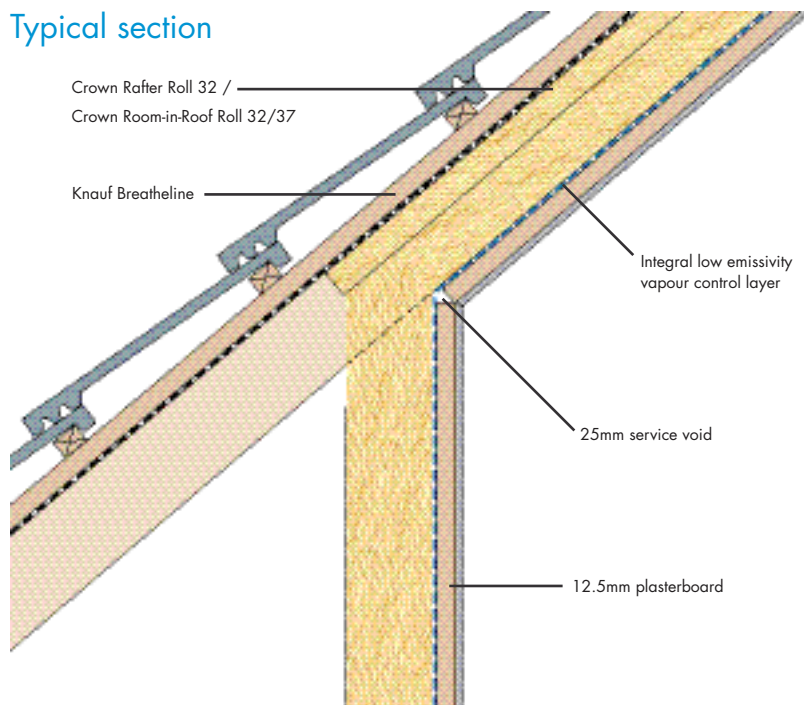
Installation

Knauf Breatheline is pulled taught and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter. Alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed, to the manufacturer's recommendations.

Friction fit, if required, a layer of Crown Rafter Roll 32 into the rafter space leaving sufficient depth to accommodate the Crown Room-in-Roof Roll 32/37 when this is installed between the rafters. The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging. Staple the laps of the integral vapour control layer to the underside of the rafters and to any dwarf walls. Lap all joints in the vapour control layer. Using a self adhesive aluminised tape seal all joints and staple punctures in the air barrier; junctions between the air barrier and any walls abutting the roof and any penetrations through the roof, such as roof windows. The vapour control layer should be linked to the air barrier in the external walls. Nail 50mm wide timber battens along the line of the rafters.

The battens to be a minimum of 25mm deep but to suit the required depth of the service void. After installing first fix services, nail plasterboard to the timber battens. Finish the plasterboard using standard drylining techniques.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32*/37*,... mm thick friction fitted between the rafters. The width of the insulation should be appropriate to the spacing of the rafters.

(*Delete as appropriate)

The integral low-emissivity vapour control layer to be stapled to the rafters with all joints well sealed. 50x25mm timber battens nailed along the line of the rafters to form a service void.

12.5mm plasterboard nailed or screwed to the timber battens at maximum 300mm centres and finished using standard drylining techniques.



Alternatively, refer to NBS clauses.

Performance

Thermal performance

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

Crown Room-in-Roof Roll 32 has a thermal conductivity of 0.032 W/mK.

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Table 14 gives U-values for typical constructions with insulation between the rafters.

Acoustic performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 meet the specification for a mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Fire performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-values achieved are shown in Table 14.

Table 14: Typical U-values with insulation between rafters with service void

Product	Thickness	U-values (W/m ² K)				
Between rafters	(mm)	50	65	75	85	100
Crown Room-in-Roof Roll 32	100	0.22	0.19	0.18	0.18	0.16
	(mm)	50	65	75	85	100
Crown Room-in-Roof Roll 37	200	0.15	0.14	0.13	0.13	0.12
	160	0.18	0.16	0.15	0.15	0.14
	100	0.24	0.21	0.20	0.19	0.17

Note: Rafters assumed to be 38mm wide at 600 centres (6.3 % bridging). The U-values have been calculated in accordance with BS EN ISO 6946: 1997.

Low emissivity airspace is assumed to have a thermal resistance of 0.34m²K/W

Pitched roofs – rafter level

Between rafters with Multifoil



Thinsulex

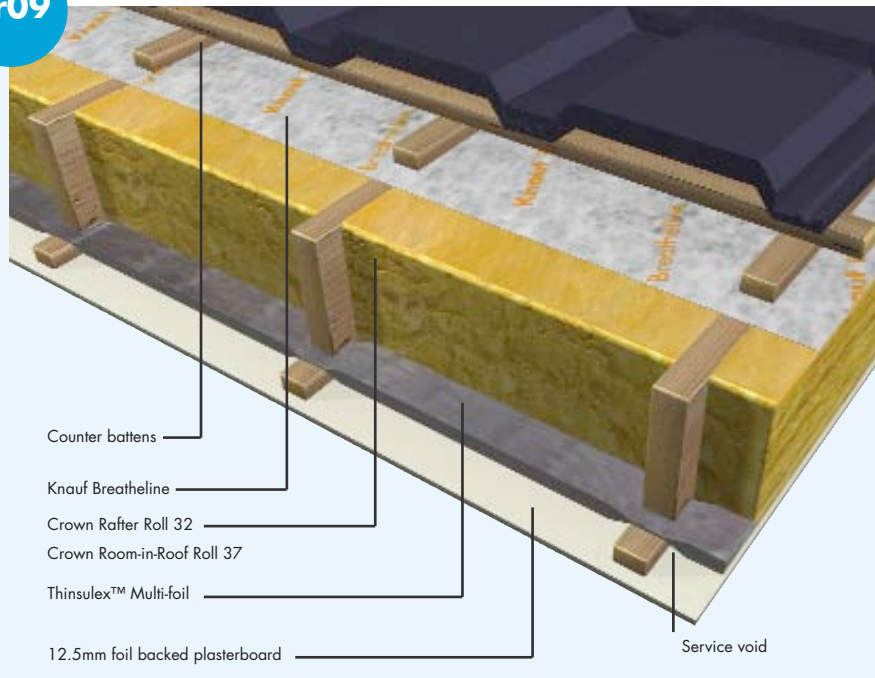


Knauf Breatheline

Pr09

Advantages

- ✓ Using Crown Rafter Roll 32/Crown Room-in-Roof Roll 37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Crown Rafter Roll 32/Crown Room-in-Roof Roll 37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Thinsulex™ Multi-foil is an insulation product comprising multilayers of insulation separated by multiple layers of sheets of reflective surfaces.

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

Knauf Breatheline is pulled taut and laid directly over the rafters. 50x32mm counter battens are nailed into the rafters with minimum penetration of 38mm into the rafter - alternatively, helical fixings can be used with a minimum penetration of 35mm into the rafter. Tiling battens are nailed into the counter battens. Finally, the roofing tiles or slates are fixed, to the manufacturer's recommendations.

With Crown Rafter Roll 32 or Crown Room-in-Roof Roll 37 between the rafters. Thinsulex Multi-foil is stapled to the underside of the rafters with 12.5mm foil backed plasterboard as the internal lining.

The full thermal performance of Thinsulex is only achieved when there is an airspace on both sides of the insulation.

25mm deep cross battens are nailed through the Thinsulex into the rafters to create an airspace below the Thinsulex.

Installation

Knauf Breatheline is pulled taut and laid directly over the rafters. Counter battens are nailed into the rafters. Tiling battens are nailed into the counter battens and the roofing tiles or slates are fixed, to the manufacturer's recommendations.

The insulation is fitted from below once the roof is weathertight. Friction fit Crown Room-in-Roof Roll 37 between the rafters. Alternatively friction fit Crown Rafter Roll 32 between the rafters (in layers if necessary). The insulation should be butt jointed and continuous with the wall insulation to avoid thermal bridging.

Staple Thinsulex Multi-foil to the underside of the rafters. Tape all joints with aluminised tape.

Nail 32x25mm timber cross battens at 600mm centres into the rafters. After installing first fix services, nail foil backed plasterboard to the timber battens. Finish the plasterboard using standard drylining techniques.

Performance

Thermal performance

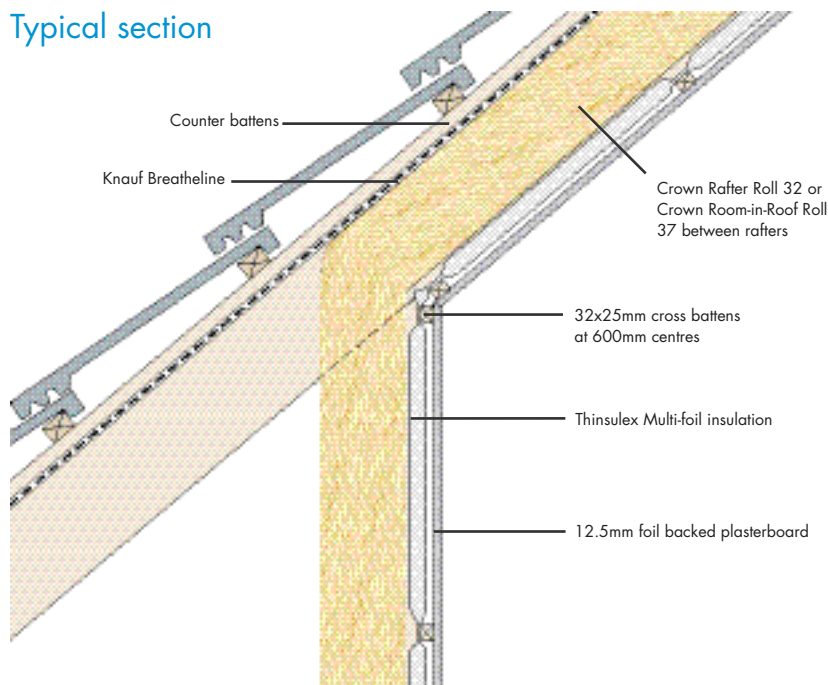
Crown Rafter Roll 32 has a thermal conductivity of 0.032 W/mK.

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Thermal resistance of Thinsulex Multi-foil including air layers and bridging is 1.37 m²K/W (1 airspace)¹ and 1.69 m²K/W (2 airspaces)².

Table 15 gives U-values for typical constructions with insulation between the rafters and Thinsulex Multifoil, with either one or two airspaces, below the rafters.

Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Rafter Roll 32 or Crown Room-in-Roof Roll 37, friction fitted between the rafters.

(*Delete as appropriate)

The width of the insulation should be appropriate to the spacing of the rafters.

Thinsulex Multi-foil to be stapled to the underside of the rafters, with all joints taped with aluminised tape.

32x25mm timber cross battens to be nailed into the rafters at 600mm centres. 12.5mm foil backed plasterboard to be nailed or screwed to the timber battens at maximum 300mm centres and finished using standard drylining techniques.



Alternatively, refer to NBS clauses.

Acoustic performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 meet the specification for a mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Fire performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 32/37 are classified as Euroclass A1 to BS EN ISO 13501-1.

Thinsulex Multi-foil will not contribute to the development stages of a fire or present a smoke or toxic hazard.

Vapour resistance

Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Refurbishment of existing roofs

This is a valid solution for the refurbishment of an existing roof where the roof tiles and roof tile underlay are not being removed. In these circumstances a continuous 50mm gap must be maintained between the insulation and the roof tile underlay which is vented at the eaves and ridge.

The U-value achieved is as shown in Table 15.

Table 15: Typical U-values for roofs with insulation between and below rafters, with a service void

Product	Thickness (mm)	Thinsulex (2 air spaces) ² U-values (W/m ² K)	Thinsulex (1 air spaces) ¹ U-values (W/m ² K)
Crown Rafter Roll 32	200 (2x100)	0.14	0.15
	170 (2x85)	0.16	0.16
	150 (2x75)	0.17	0.18
	130 (2x65)	0.19	0.20
	100	0.22	0.23
Crown Room-in-Roof Roll 37	200	0.15	0.16
	160	0.18	0.19
	100	0.23	0.25

Note: Rafters assumed to be 48mm wide at 600 centres (8% bridging). The U-values have been calculated in accordance with BS EN ISO 6946: 1997

Pitched roofs – rafter level

Between and above rafters



Polyfoam Pitched Roofboard

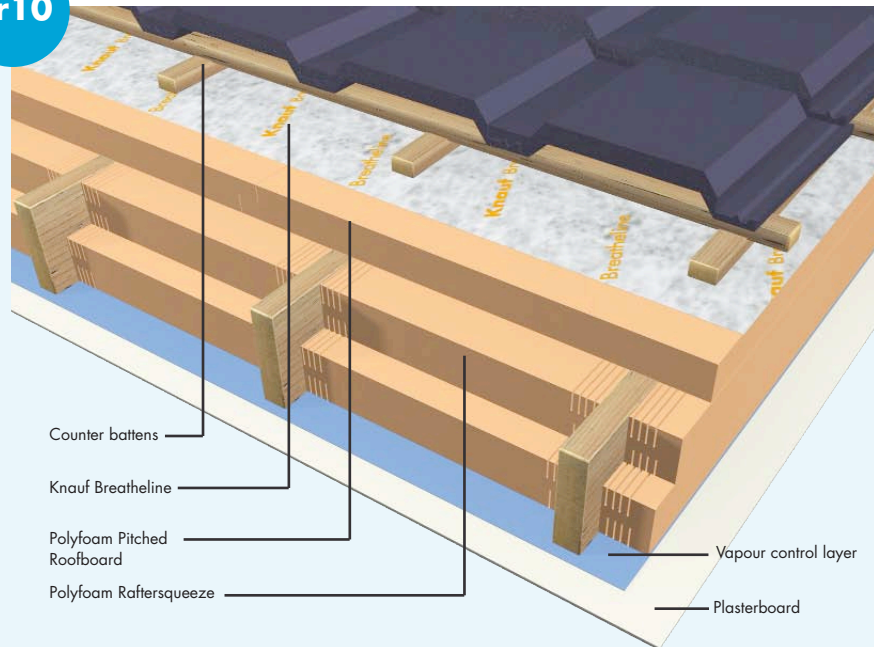


Knauf Breatheline

Pr10

Advantages

- ✓ Polyfoam Pitched Roofboard can be used with any rafter spacing
- ✓ Vertical joints do not need to occur at rafters, making installation quick and simple
- ✓ Polyfoam is lightweight yet very strong, making it easy to handle on the roof
- ✓ Polyfoam Raftersteeze fits tightly to the sides of rafters



Products

Polyfoam Pitched Roofboard is a 100% ozone friendly, extruded polystyrene, rigid board insulation system. It is lightweight with shiplap edge details that do not have to meet directly on top of rafters, making installation very quick and simple.

Polyfoam Raftersteeze is a 100% ozone friendly, extruded polystyrene, rigid board insulation – it is lightweight and consists of a flexible infill piece of insulation that fits between rafters, and allows for some timber variation.

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides – see also page 534.

Typical construction

A pitched roof of timber rafters with tiles or slates on battens and Knauf Breatheline. Insulated with Polyfoam Pitched Roofboard laid over rafters and Polyfoam Raftersteeze fitted between rafters.

Installation

A timber stop rail is fixed to the ends of the rafters. Polyfoam Pitched Roofboard is fitted starting from the timber stop rail, with all boards tightly butted.

The board is not suitable to be walked on, as defined in HSE33, except when covered with supporting timbers.

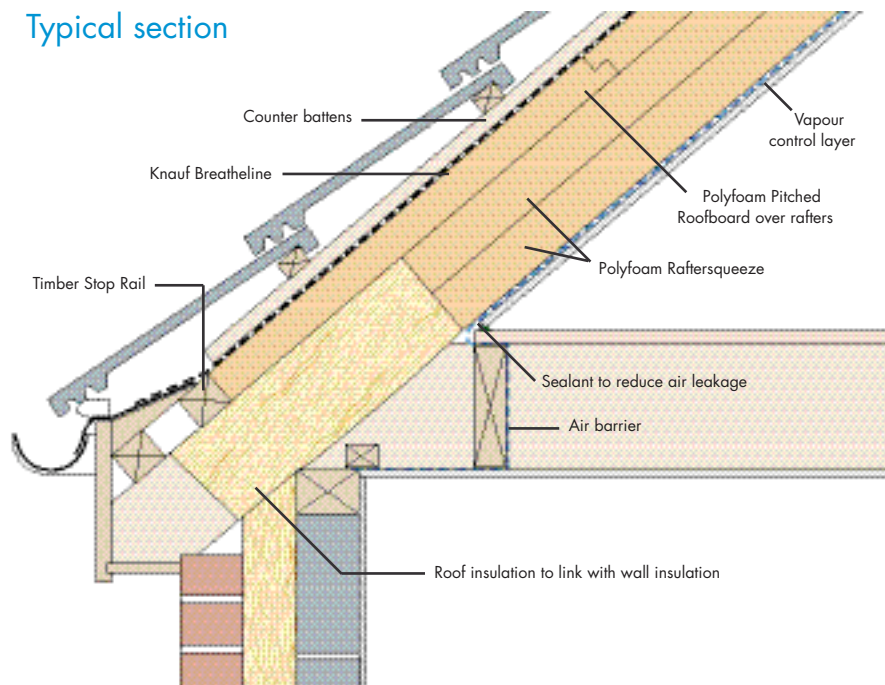
Knauf Breatheline, is pulled taught and laid directly over the insulation.

50 x 32mm counter battens are nailed through the Knauf Breatheline and Polyfoam Pitched Roofboard and into the rafters using spiral fixings such as Helifix Inskew 600 or Buildex RG, with minimum penetration into the rafter of 35mm. Tiling battens are laid across the roof and nailed into the counter battens. Tiles should be stacked so that they bear directly over the rafters. Finally, the roofing tiles or slates are fixed to the manufacturer's recommendations.

Once Polyfoam Pitched Roofboard is fixed in place, Polyfoam Raftersteeze is friction fitted between the rafters. If rafter centres are other than 600mm (e.g. 450mm, 300mm etc) cut the board slightly oversize to fit and use the remaining squeeze on one edge to push fit between rafters. They boards should be pushed up to the underside of the Polyfoam Pitched Roofboard, so there are no gaps. A timber batten or noggin fixed into the rafter below the Polyfoam Raftersteeze (optional) can be used to hold the board in position.

There is an alternative fixing method for counter and tiling battens which is described in British Board of Agrément Certificate 06/4386.

Typical section



Typical specification

Insulation laid over rafters to be Polyfoam Pitched Roofboard,mm thick. Knauf Breatheline is then pulled taut and laid directly over the insulation and held in place by 50 x 32mm counter battens nailed through the boards, into the rafters. The tiling battens to be nailed into the counter battens.

Insulation between the rafters to be Polyfoam Rafter squeeze, supported on battens nailed to the side of the rafters (optional).



Alternatively, refer to NBS clauses: K11/670 and P10/140 and 320

Performance

Thermal performance

Polyfoam Pitched Roofboard has a thermal conductivity of 0.029 W/mK.

Polyfoam Rafter squeeze has a thermal conductivity of 0.030 W/mK.

Table 16 gives U-values for typical constructions.

Compression resistance

The rigidity of Polyfoam Pitched Roofboard makes the board easy to handle and less prone to site damage than less robust materials.

Moisture resistance

Polyfoam Pitched Roofboard is highly resistant to moisture absorption and will perform as stated if exposed to moisture in use.

Fire performance

The boards contain a flame retardant specifically designed to inhibit localised ignition. The boards will melt if brought into contact with high temperature sources. However, the use of the boards will not affect the fire rating obtained by tiled roofs when evaluated by assessment or tested to BS 476: Part 3: 2004. The underside of the rafters should be faced with 12.5mm plasterboard to provide fire protection.

Table 16: Typical U-values of pitched warm roofs insulated above and between rafters

Insulation between rafters	Thickness (mm)	U-values (W/m ² K) of Polyfoam Pitched Roofboard thickness over rafters (mm)			
		35	50	60	75
Polyfoam Rafter squeeze	150 (75+75)	0.17	0.16	0.15	0.14
	125 (75+50)	0.20	0.18	0.17	0.15
	100 (50+50)	0.23	0.21	0.19	0.17
	75	0.28	0.24	0.22	0.20

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging). The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Pitched roofs – rafter level

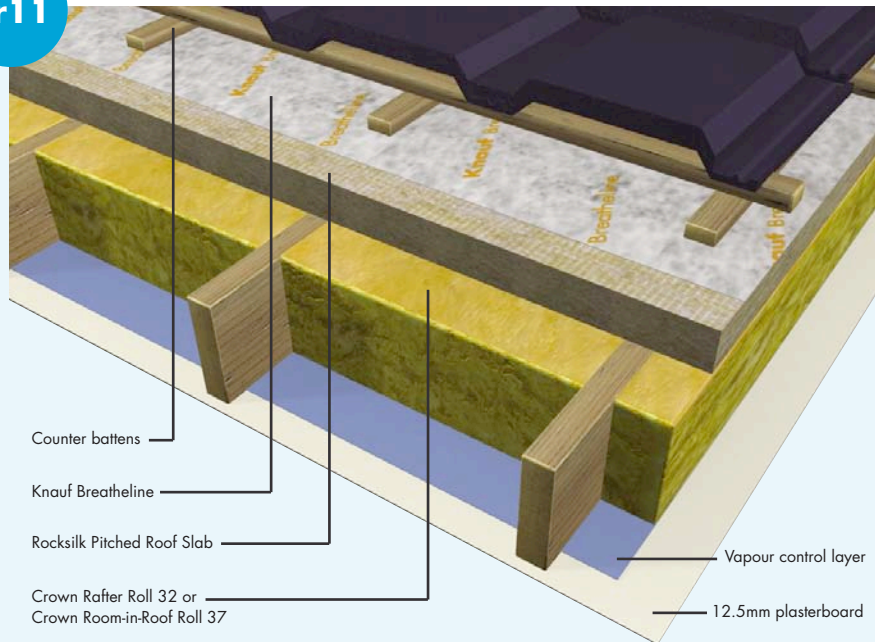
Between and above rafters



Pr 11

Advantages

- ✓ Non-combustible insulation gives fire safe solution
- ✓ No ventilation required at eaves or roof voids
- ✓ A breathable and vapour permeable system
- ✓ Significantly improves the acoustic performance of the roof
- ✓ Crown Rafter Roll 32 and Crown Room-in-Roof Roll 37 can be used along with an extra layer of plasterboard to satisfy the requirements of Robust Details to restrict flanking sound around separating walls
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Rocksilk Pitched Roof Slab is a compression resistant, water repellent, rock mineral wool slab specifically developed for over rafter (sarking) insulation. 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 – see also page 534.

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters with tiles or slates on battens and counter battens and Knauf Breatheline. Insulated with Rocksilk Pitched Roof Slab laid over the rafters and Crown Room-in-Roof Roll 37 or Crown Rafter Roll 32, friction fitted between the rafters.

Installation

A timber stop rail is fixed to the ends of the rafters. Rocksilk Pitched Roof Slab is fitted starting from the timber stop rail, with all slabs tightly butted.

Rocksilk Pitched Roof Slab should be laid across the finished rafters with staggered joints. The slabs should be cut to length to match the spacings of the rafters.

Knauf Breatheline can be installed either below the counter battens (as shown above), or above the counter battens. When installed above the counter battens Knauf Breatheline should be draped by no less than 10mm.

Counter battens should be fixed through the Rocksilk Pitched Roof Slab boards using spiral fixings such as Helifix Ins skew 600 or Buildex RG, with a minimum penetration into the rafter of 35mm.

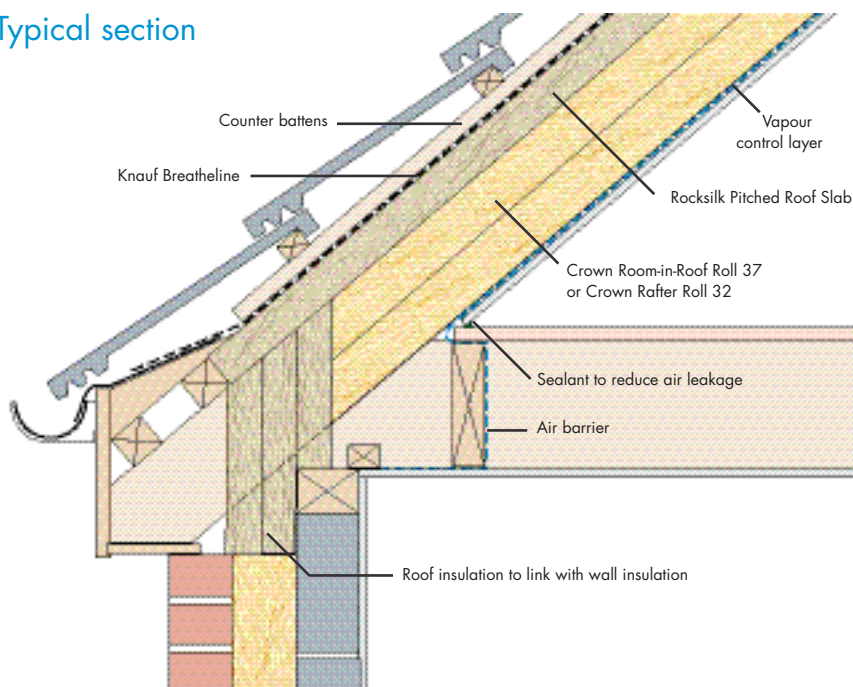
The fixings are to be installed at no greater than 400mm centres along the battens.

From below, Crown Room-in-Roof Roll 37 or Crown Rafter Roll 32 is simply friction fitted between the rafters. The insulation should be friction fitted between the rafters so that it is in direct contact with the Rocksilk Pitched Roof Slab, with no air gaps between the two layers of insulation.

To avoid a thermal bridge at the eaves, Rocksilk Pitched Roof slabs should be cut to shape to link the roof and wall insulation.

A continuous vapour control layer should be fixed to the underside of the rafters.

Typical section



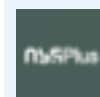
Typical specification

Insulation laid over rafters to be Rocksilk Pitched Roof Slab,mm thick, located over the rafters. All boards tightly butted and with staggered joints. Knauf Breatheline should then be laid over the insulation with the edges lapped.

The insulation and underlay to be held in place by 50 x 32mm counter battens fixed through the boards, into the rafters. The tiling battens to be nailed into the counter battens.

Crown Room-in-Roof Roll 37 or Crown Rafter Roll 32.....mm thick, to be friction fitted between the rafters.

The width of the insulation should be appropriate to the spacing of the rafters.



Alternatively, refer to NBS clauses: K11/670 and P10/140 and 320

Performance

Thermal performance

Rocksilk Pitched Roof Slab has a thermal conductivity of 0.038 W/mK.

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

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

Table 17 gives U-values for typical constructions.

Acoustic performance

Crown Rafter Roll 32 and Crown Room-in-Roof Roll 37 meet the specification for mineral wool insulation required for the control of flanking sound as described in Appendix A of Robust Details.

Fire performance

Crown Rafter Roll 32, Crown Room-in-Roof Roll 37 and Rocksilk Pitched Roof Slab are classified as Euroclass A1 to BS EN ISO 13501-1.

Table 17: Typical U-values of pitched roofs with insulation between and over rafters

Insulation	Thickness (mm)	U-values (W/m ² K) Rocksilk Pitched Roof Slab (mm)	
		50	70
Crown Room-in-Roof Roll 37	200	0.16	0.14
	160	0.18	0.17
	100	0.25	0.22
Crown Rafter Roll 32	200 (2x100)	0.14	0.14
	170 (2x85)	0.16	0.15
	150 (2x75)	0.18	0.16
	130 (2x65)	0.20	0.18
	100	0.23	0.21

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

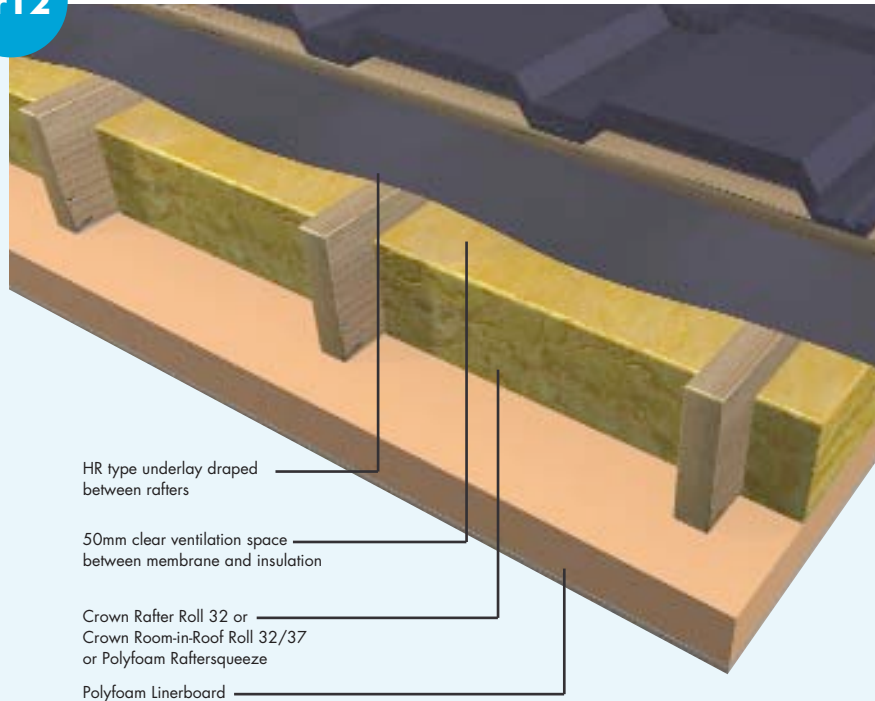
Pitched roofs – rafter level

Between and below rafters – existing roof

Pr12

Advantages

- ✓ Robust nature of Polyfoam in Linerboard supports the plasterboard, improving its impact resistance
- ✓ Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 and Polyfoam Rafter squeeze friction fit tightly to rafters
- ✓ Using Crown Rafter Roll 32/Crown Room-in-Roof Roll 32/37 will significantly improve the acoustic performance of the roof restricting airborne noise
- ✓ Suitable for upgrading existing roof
- ✓ Long rolls with greater coverage per roll than other equivalent products



Products

Crown Room-in-Roof Roll 32/37 is made from glass mineral wool and formed into rolls which are dimensioned to fit tightly between rafters at 600mm centres. The rolls are lightweight, flexible, resilient, non-combustible, and are faced with a low emissivity vapour control layer. The facing is wider than the roll to overlap the rafters to aid fixing, and create a vapour control layer. Their manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Crown Rafter Roll 32 is made from glass mineral wool and formed into rolls which are lightweight, flexible, resilient and non-combustible. Its manufacture has a very low impact on the environment and is classified as Zero ODP and Zero GWP*

Polyfoam Rafter squeeze is a 100% ozone friendly, extruded polystyrene insulation. It consists of a flexible infill piece of insulation that fits between rafters, and allows for some timber variation

Polyfoam Linerboard is a laminate of Polyfoam extruded polystyrene and 9.5mm tapered edge plasterboard

* Ecohomes and Code for Sustainable Homes classification

Typical construction

A pitched roof of timber rafters with tiles or slates on battens on an HR type underlay. Insulated with Crown Room-in-Roof Roll 32/37, Crown Rafter Roll 32 or Polyfoam Rafter squeeze between the rafters and lined internally with Polyfoam Linerboard.

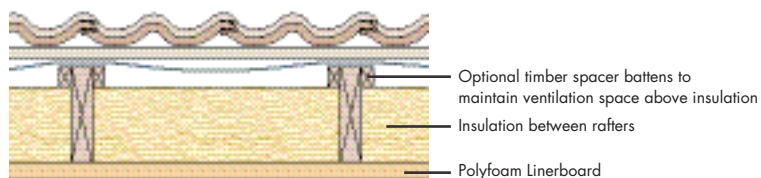
There must be a continuous 50mm gap above the insulation which is vented at the eaves and ridge. This is the most popular method for insulating an existing roof when a loft is converted to habitable accommodation.

Installation

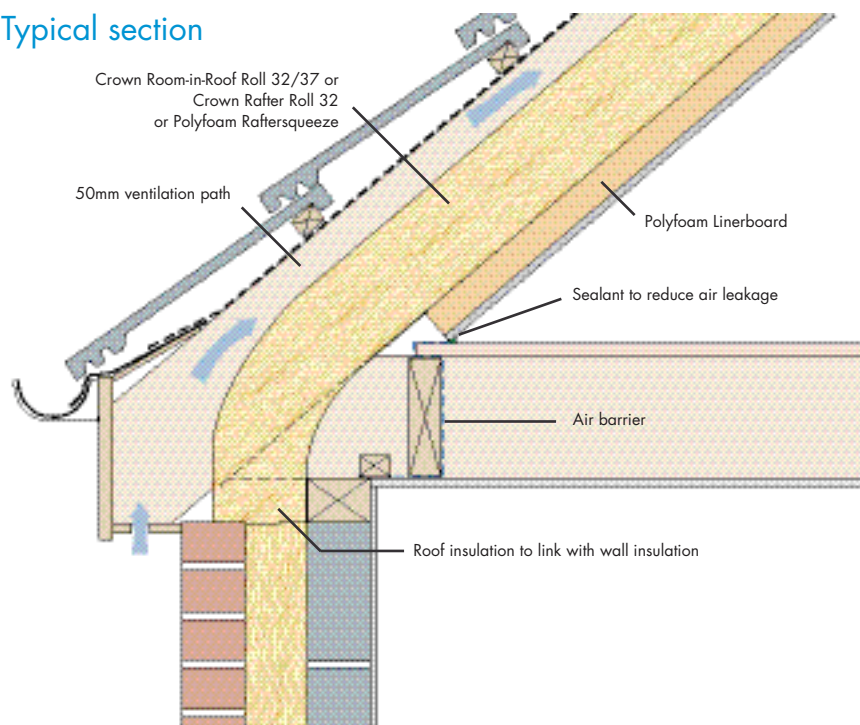
Crown Room-in-Roof Roll 32/37 or Crown Rafter Roll 32 is friction fitted (in layers if necessary) between the rafters, taking care to leave a 50mm gap above the insulation. The rolls should be butt jointed and continuous with the wall insulation to avoid thermal bridging.

Alternatively, Polyfoam Rafter squeeze is fitted between the rafters. If rafter centres are other than 600mm (e.g. 450mm, 300mm etc) cut the board slightly oversize to fit and use the remaining squeeze on one edge to push fit between rafters.

Finally, Polyfoam Linerboard is nailed or screwed to the underside of the rafters at maximum 300mm centres at least 12mm in from the board edge. The fixings should be long enough to penetrate at least 25mm into the timber. The boards are finished using standard drylining techniques.



Typical section



Typical specification

The whole area of the pitched roof to be insulated with Crown Room-in-Roof Roll 32/37*/Crown Rafter Roll 32/Polyfoam Rafter squeeze*mm thick, friction fitted between the rafters, with a continuous 50mm ventilation space above the insulation. The width of the insulation should be appropriate to the spacing of the rafters.

Polyfoam Linerboard of thicknessmm with integral 9.5mm plasterboard nailed or screwed to the rafters at maximum 300mm centres and finished using standard drylining techniques.

(*Delete as appropriate)



Alternatively, refer to NBS clauses: P10/140 and 320, and K10/245

Performance

Thermal performance

Crown Room-in-Roof Roll 32 has a thermal conductivity of 0.032 W/mK.

Crown Room-in-Roof Roll 37 has a thermal conductivity of 0.037 W/mK.

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

Polyfoam Rafter squeeze and the insulation in Polyfoam Linerboard has a thermal conductivity of 0.030 W/mK.

Table 18 (opposite) gives U-values for typical constructions with insulation between and below the rafters.

Compression resistance

The rigidity of the Polyfoam in Polyfoam Linerboard offers an excellent support to the finished internal lining and assists in the resistance of impact, helping to prolong its service life.

Fire performance

Crown Room-in-Roof Roll 32/37 and Crown Rafter Roll 32 are classified as Euroclass A1 to BS EN ISO 13501-1.

Table 18: Typical U-values of roofs with insulation between and below rafters

Product	Thickness (mm)	U-values (W/m ² K)		
		Polyfoam Linerboard Thickness (mm)		
		25.5/9.5	36/9.5	45.5/9.5
Crown Room-in-Roof Roll 32	100	0.26	0.24	0.22
Crown Rafter Roll 32	200 (2x100)	0.15	0.15	0.14
	160 (75+85)	0.19	0.17	0.17
	100	0.20	0.19	0.18
Crown Room-in-Roof Roll 37	200	0.17	0.16	0.15
	160	0.20	0.19	0.18
	100	0.28	0.26	0.24
Polyfoam Rafter squeeze	150 (2x75)	0.20	0.18	0.17
	140 (65+75)	0.21	0.19	0.18
	125 (50+75)	0.22	0.21	0.20
	100 (2x50)	0.26	0.24	0.22

Notes: Rafter sizes assumed to be 38mm wide at 600mm centres (6.3% bridging) and the same depth as the insulation. The U-values have been calculated in accordance with BS EN ISO 6946:1997.

Polyfoam insulation contains a flame retardant specifically designed to inhibit localised ignition. The boards will melt if brought into contact with high temperature sources and are classed as combustible.

However, the use of the boards will not affect the fire rating obtained by tiled roofs when evaluated by assessment or tested to BS 476: Part 3: 2004.

Polyfoam Linerboard is faced with 9.5mm plasterboard which offers excellent fire performance.

Pitched roofs

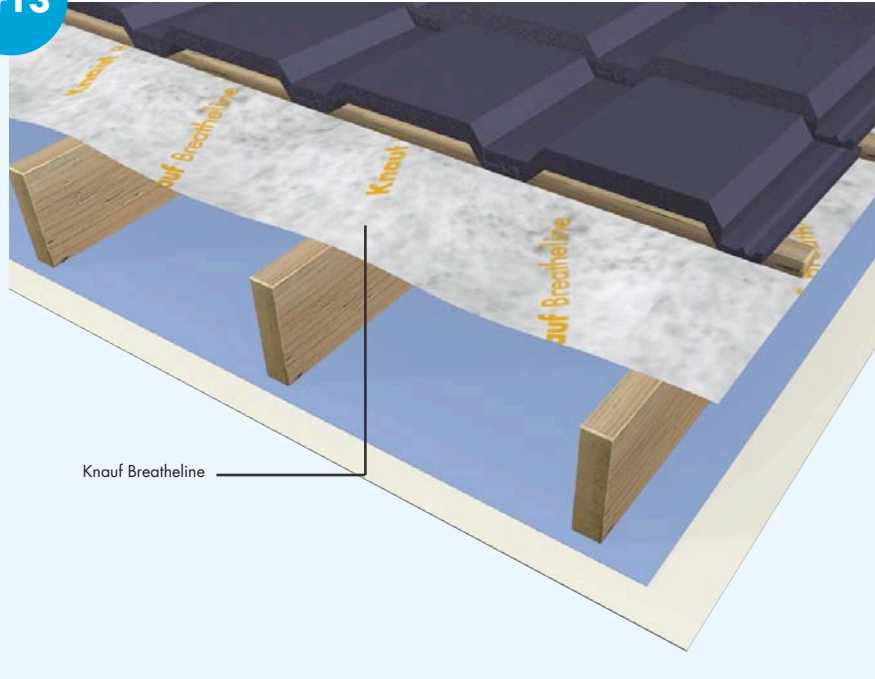
Vapour permeable underlays



Pr13

Advantages

- ✓ Low vapour resistance – Knauf Breatheline is classified as an LR underlay as defined in BS5250
- ✓ Allows the continuous diffusion of moisture from the whole area of the pitched roof under all wind conditions
- ✓ Waterproof to wind driven rain and snow
- ✓ Excellent nail tear and tensile strength
- ✓ Can be laid directly over insulation or sarking boards as there is no capillary action through the underlay
- ✓ When installed in accordance with the BBA Certificate there is no requirement for ventilation of the roof space



Products

Knauf Breatheline is a breathable membrane with a polypropylene non-woven coating on both sides. It is classified as a type LR roof tile underlay according to the specification in BS 5250.

Typical construction

Knauf Breatheline can be used in both warm and cold pitched roofs.

In cold pitched roofs, Knauf Breatheline is normally draped about 10-15mm between the rafters to allow wind driven rain and snow to drain below the tiling battens into the gutter. At the eaves, Knauf Breatheline should not be exposed to the long term effects of sunlight – a type 5U felt underlay or eaves carrier should be used and dressed into the gutter.

In warm pitched roofs, where the insulation stops short of the top of the rafters, it can be draped 10-15mm between the rafters.

In warm pitched roofs where the membrane is fully supported by insulation or sarking boards, counter battens are required.

Installation

Always use non-ferrous staples or nails to fix Knauf Breatheline at 300mm centres.

Use the dotted lines printed on the underlay to indicate the size of laps when laying subsequent lengths of underlay.

Unsupported underlays

Knauf Breatheline is laid parallel to the eaves and draped between the rafters as traditional tiling underlays.

Knauf Breatheline underlays can also be draped over counter battens in boarded and warm roofs.

Supported underlays

Whenever rigid insulation or timber boarding is fixed directly onto the rafters, counter battens must be used.

Counter battens can either be fixed directly onto the boarding with Knauf Breatheline draping between the counter battens or it can be laid directly over the boarding or insulation and the counter battens fixed on top.

Performance

Vapour resistance

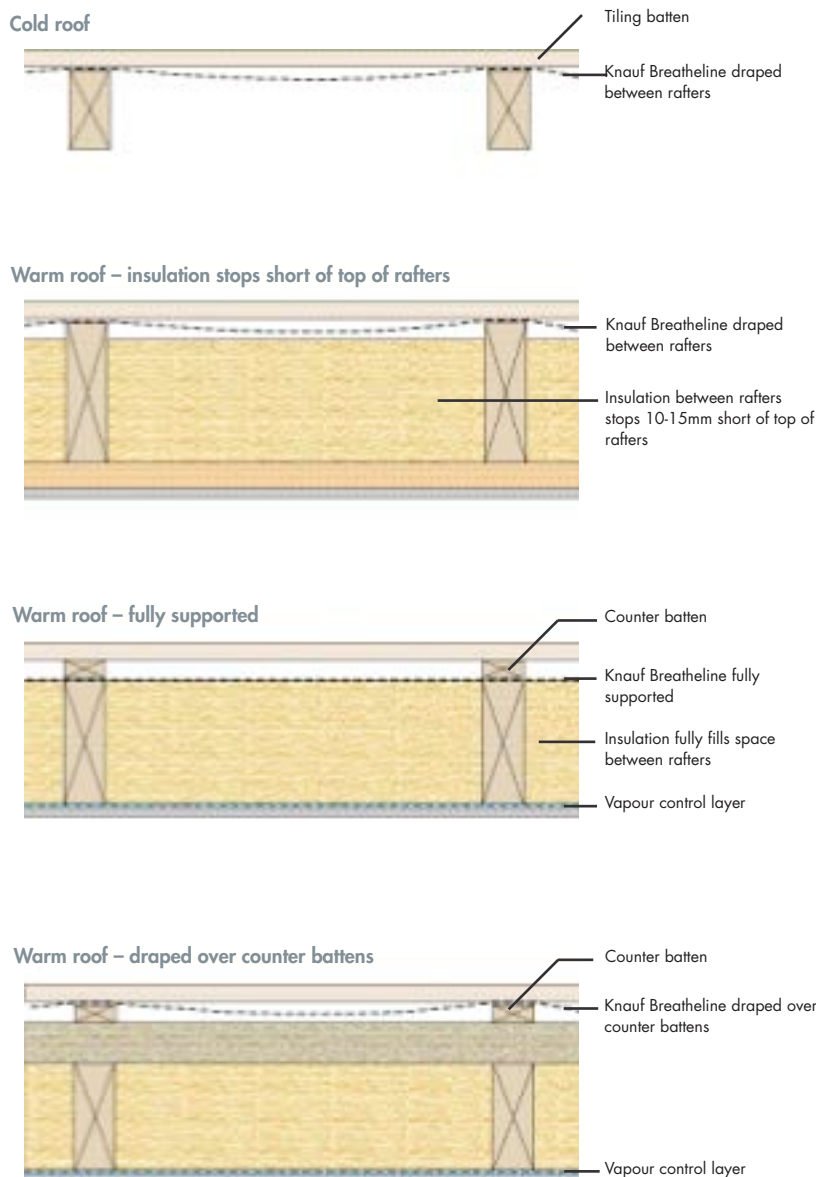
Knauf Breatheline has a vapour resistance of 0.22 MNs/g.

Table 19: Ventilation requirements for LR underlays

LR underlay approval	type of ceiling	Size of ventilation openings at:	
		eaves	high level
No technical approval	Normal	7mm	5mm
No technical approval	Well sealed*	3mm	5mm
With technical approval	Normal	7mm	5mm
With technical approval	Well sealed*	Not required	Not required

*See page 152 for definition of well sealed ceiling.

Alternative positions for Knauf Breatheline



Typical specification

Fully supported underlay

Knauf Breatheline should be laid horizontally across the roof slope, pulled taut, with the bottom edge lapping the eaves tray by 150mm. Fix with non-ferrous nails or staples to each rafter at maximum 300mm centres. Nail counter battens along the line of the rafters. Nail the tiling battens to the counter battens at centre required by the roof finish. Use the battens as footholds to position and fix the next roll. Specification should be based on, and referenced to BBA Certificate 03/4014. Horizontal and vertical laps to be in accordance with BS 5534: 2003.

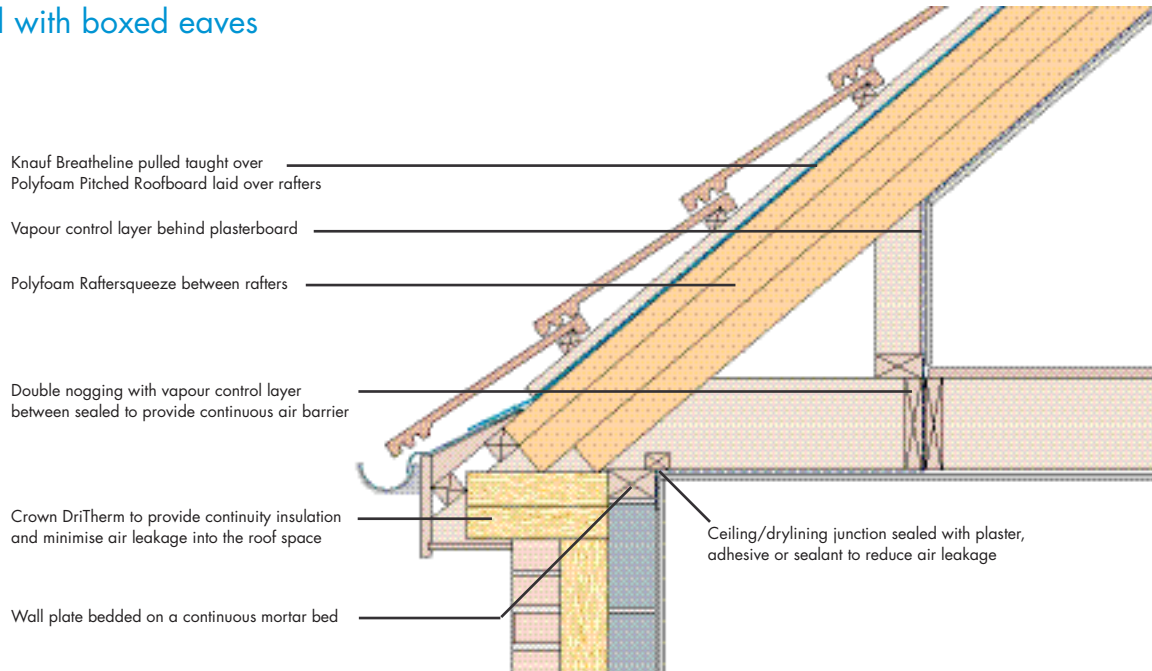
Unsupported underlay

Knauf Breatheline should be laid horizontally across the roof slope, with the bottom edge lapping the eaves carrier by 150mm. Drape the underlay 10-15mm between rafters. Fix with non-ferrous nails or staples to each rafter at maximum 300mm centres. Nail the tiling battens to the rafters*/counter battens* at centre required by the roof finish. Use the battens as footholds to position and fix the next roll. Specification should be based on, and referenced to BBA Certificate 03/4014. Horizontal and vertical laps to be in accordance with BS 5534: 2003.

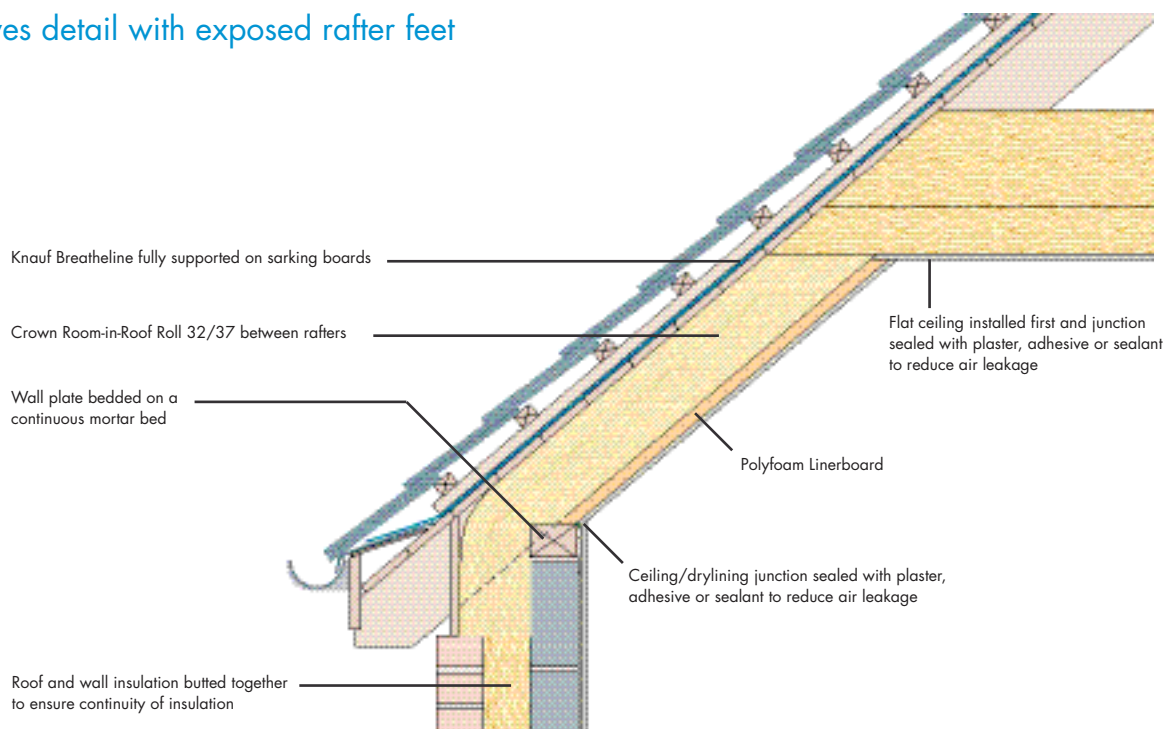
Pitched roofs

Typical eaves details

Eaves detail with boxed eaves



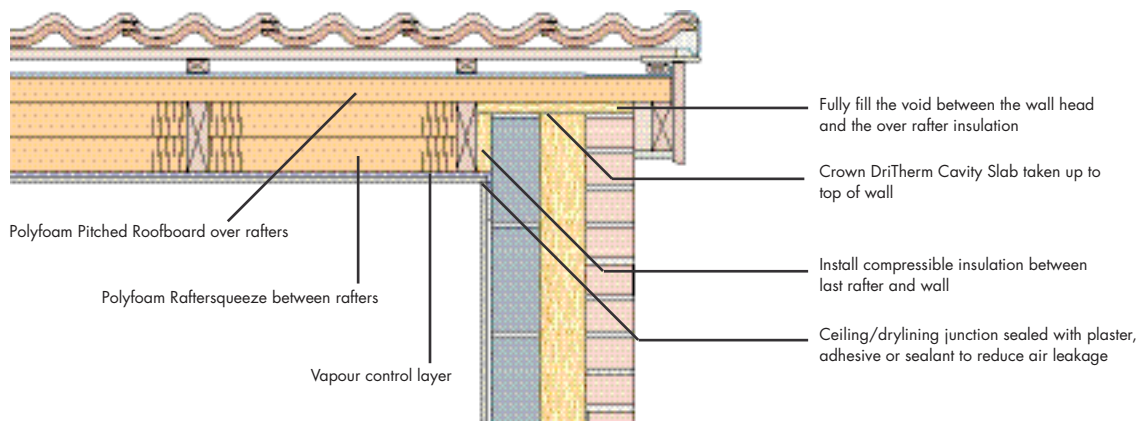
Scottish eaves detail with exposed rafter feet



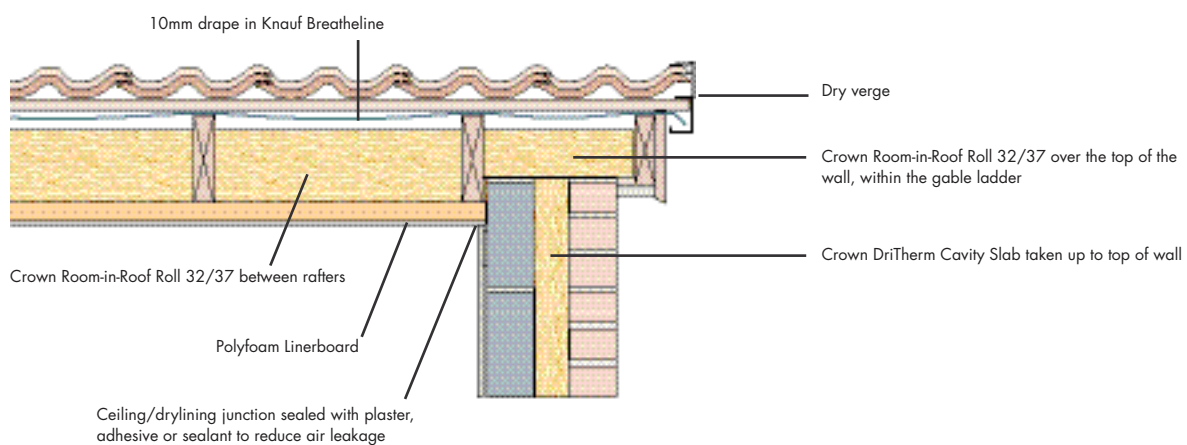
Pitched roofs

Typical verge details

Typical overhanging verge detail with insulation over and between rafters



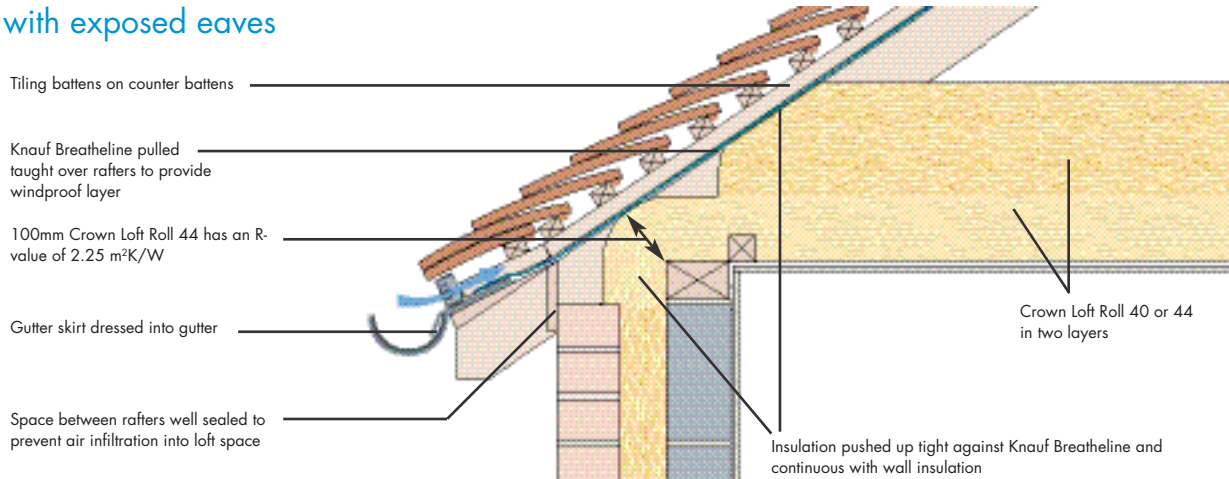
Typical overhanging verge detail with insulation between and under rafters



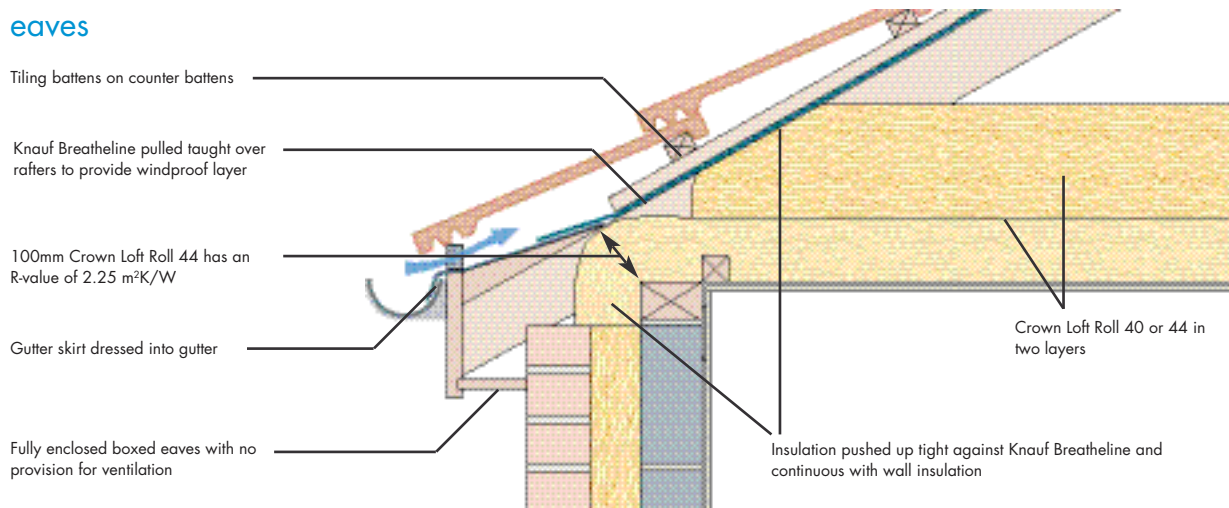
Pitched roofs

Typical ceiling level details

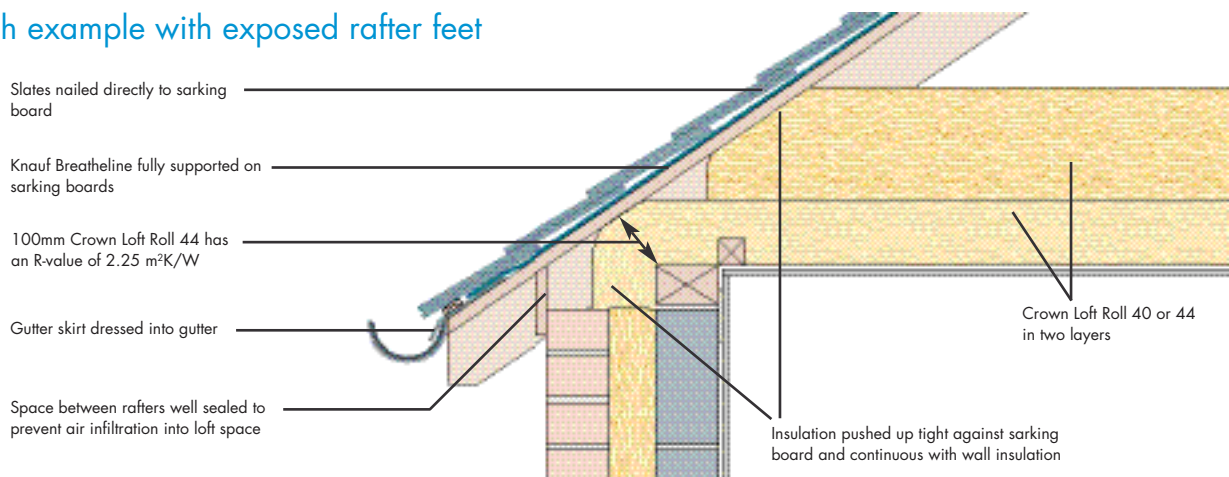
Detail with exposed eaves

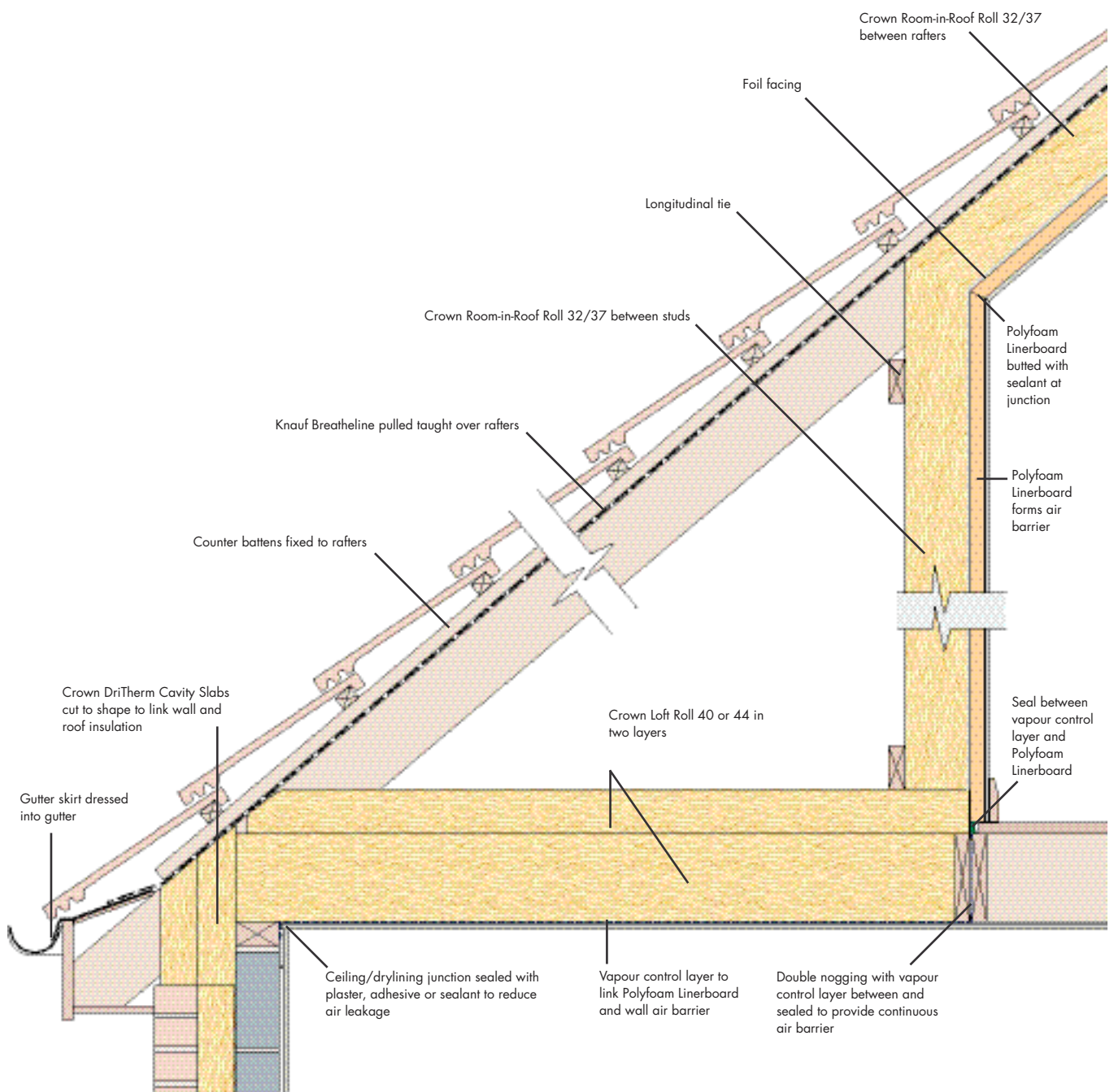


Boxed eaves

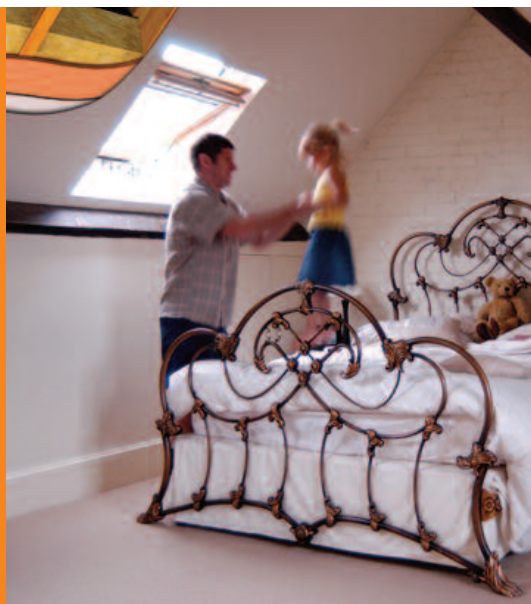


Scottish example with exposed rafter feet





KNAUFINSULATION



Ref: KB55608

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it's time to save energy

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