

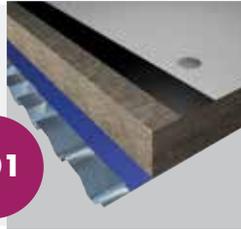
Section 2.3

Flat Roofs

Warm deck single ply membrane

Product: RocksilK Krimpack Flat Roof Slab

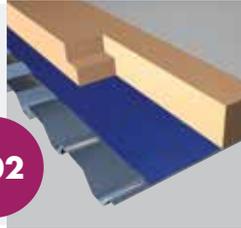
FI01



Warm deck single ply membrane

Product: Polyfoam ECO Roofboard

FI02



Warm deck built-up felt/mastic asphalt

Product: RocksilK Krimpack Flat Roof Slab

FI03



Protected membrane

Products: Polyfoam ECO Roofboard and Polyfoam Slimline membrane

FI04



Warm deck car park roof

Product: Polyfoam ECO Roofboard Super

FI05



Cut-to-falls

Product: RocksilK Krimpack Cut-To-Falls system

FI06



Cut-to-falls

Product: Polyfoam ECO Cut-To-Falls system

FI07



Flat roofs

Flat roof design

Condensation

Thermal insulation and the flow of heat and water vapour through a construction are inextricably linked. The position of thermal insulation, vapour control layer and the need for ventilation must all be considered together. The likelihood of condensation occurring will depend on the position of the insulation in the roof construction, the U-value of the roof, the relative humidity and temperature of the internal environment and whether an effective vapour control layer has been provided. To prevent surface condensation, the roof must be kept above the dew point of the internal air with an appropriate thickness of insulation, correctly located. To prevent interstitial condensation, an effective vapour control layer must be installed on the warm side of the insulation.

Warm and cold roofs

The position of the thermal insulation in relation to the structural roof deck has created two basic categories of roof design:

- Warm roofs
- Cold roofs

A warm roof has the insulation above the structural deck, which is thus kept warm. The waterproof layer is above the insulation and a vapour control layer is placed below the insulation.

An inverted/protected membrane roof is a form of warm roof in which the insulation is placed above the waterproof covering (which also acts as a vapour control layer).

A cold roof has the insulation placed below the structural deck, which thus remains cold. This construction relies on a vapour control layer working effectively, and in tandem with a

continuous ventilated airspace to disperse the water vapour to atmosphere before it reaches the cold deck and condenses.

This section only considers warm roofs as follows:

- Warm roof with built-up felt or mastic asphalt roof covering
- Warm roof with single ply membrane
- Inverted/protected membrane/green roof

Roof loadings

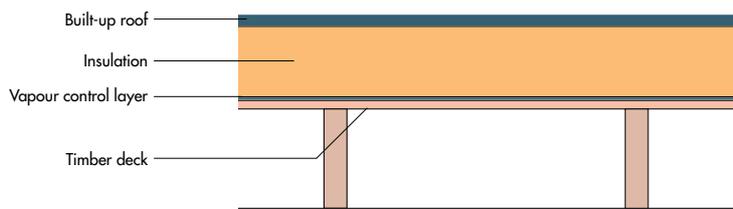
The roof structure must be capable of supporting all of the associated loadings. In addition, the wind pressure acting on the roof should be assessed in accordance with BS EN 1991-1-4:2005+A1:2010.

Drainage

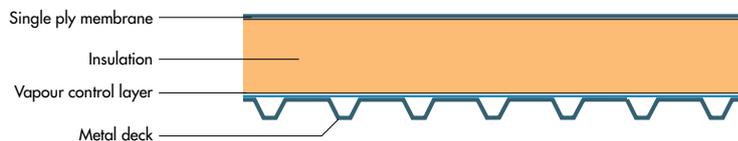
Guidance on the number and size of rainwater outlets can be obtained from BS EN 12056-Part 3: 2000. The drainage and edge details should be installed as per the waterproofing membrane manufacturer's instructions.

The three types of warm deck considered in this section

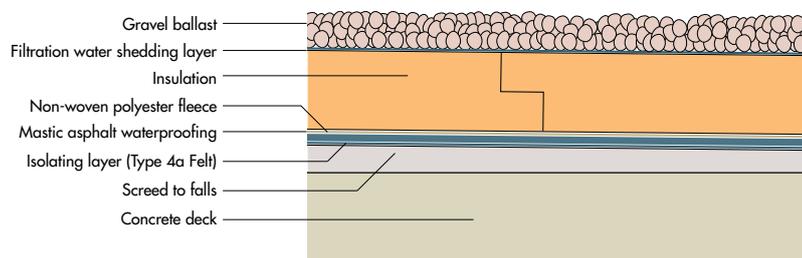
1. Warm deck – built-up roof



2. Warm deck – single ply membrane



3. Inverted/protected membrane/green roof – mastic asphalt waterproofing



Flat roofs

Flat roof design



Built-up felt/mastic asphalt

Concrete, timber and metal deck flat roofs can all be designed as warm roofs with a built-up felt or mastic asphalt roof covering. Installation of the roof covering should be in accordance with the manufacturer's instructions with due consideration being taken of fixing methods and wind uplift.

An integral part of a warm deck flat roofing system is the installation of the vapour control layer on the warm side of the insulation.

Single ply

Concrete, metal and timber deck flat roofs can all be designed as flat roofs with a single ply roof covering. Installation of the roof covering should be in accordance with the manufacturers instructions with due consideration being taken of fixing methods and wind uplift.

An integral part of a warm deck flat roofing system is the installation of the vapour control layer on the warm side of the insulation.

When insulation is placed over the deck, an insulant with a low rate of thermal expansion should be selected with adequate mechanical strength to resist the compressive and tensile loads during installation and in service. Differential movement can be avoided by laying a single ply waterproof membrane and mechanically fixing it through the insulation to the deck, using an approved fully bonded system or leaving the membrane loose and covering with ballast.

Refer to the Single Ply Roofing Association (SPRA) Design Guide for Single Ply Roofing for advice on alternative fixing methods.

Fixing of insulation/single membrane

Where the insulation is mechanically fixed rather than bonded to the roof deck, the wind uplift capability of the roof finish depends entirely on the mechanical fixings.

When mechanically fixed, the roof membrane may be temporarily lifted by wind suction.

It is advisable with mechanically fixed membranes to ensure that all insulation slabs or boards are fixed to the structural deck to avoid them moving out of position during windy periods.

When mechanically fixing or fully bonding the membrane the systems should be designed to withstand the wind loadings calculated in accordance with BS EN 1991-1-4:2005+A1:2010.

Suitable mechanical fixings and adhesives are readily available for use with all types of deck.

PVC single ply membranes

Where extruded polystyrene insulation boards are used with a PVC membrane, a separating layer must be placed between the PVC membrane and the insulation to prevent plasticiser migrating out of the membrane. This may take the form of a glass fibre or polyester fleece with a minimum density of 100 g/m², or a foil facing to the insulation board. An alternative is to use a membrane with an integrally bonded fleece backing. EPDM and polyolefin membranes do not require a separating layer.

Vapour control layers

The vapour control layer may take the form of a bitumen bonded felt, a nailed felt layer or a reinforced polyethylene sheeting. If in doubt please contact our Technical Advice and Support Centre on 01744 766666.

Protection of insulation during installation

To prevent moisture entrapment on or in the insulation boards it is essential to protect them during laying and before the application of the roof waterproofing, or to lay the roof covering at the same time as the board.

Standards

BS 6229:2003 is the code of practice for flat roofs with continuously supported coverings. It recommends that they are inspected at least twice a year in spring and autumn as a minimum and also after events which may have had a detrimental effect on the roof covering, such as violent storms. Workmanship on flat roofs is covered by BS 8000: Part 4: 1989.

Flat roofs

Flat roof design

Inverted/protected membrane roofs

With insulation placed above the waterproof membrane the latter is protected from extremes of temperature and thus shielded from excessive thermal stress, this will normally result in an extended life. An inverted/protected membrane roof places additional requirements on the thermal insulation which needs to have the following properties:

- Low water absorption in service (including freeze/thaw cycles)
- High compressive strength to withstand ballast load and support surface traffic

BS 6229 : 2003 recommends a minimum finished fall of 1:60 or 1:80 dependent on the waterproofing covering. In the absence of detailed analysis a fall equal to twice that of the minimum finished fall should be assumed for design purposes.

For roofs with slopes below 1:80 the asphalt waterproofing must be tanking grade and a separating membrane placed between the waterproofing and the insulation.

Where the filter membrane above the insulation also forms a water resistant layer, as in the Polyfoam Slimline system, there is an increase in surface water run-off above the insulation, ensure that the capacity and location of gulleys and outlets is sufficient to cope with this. Further details can be found in BS 12056: Part 3 : 2000.

Roof loadings

Inverted/protected membrane roofs can be constructed on concrete, timber or metal decks. The structure must be capable of supporting the weight of the loading layer to the satisfaction of the structural engineer.

The loading layer can be provided by washed, graded and rounded gravel of nominal diameter 20-40mm (free from fines) or by dense concrete paving slabs or by a green/garden roof system.

A loading layer is necessary to prevent the insulation boards being lifted by high winds or floatation as water drains from the roof. It also protects the insulation from the effects of UV light and contributes towards the roofs fire rating. For heavily trafficked areas, concrete paving slabs should be used to form the loading layer.

Where gravel ballast is used paving slabs are required at exposed edges (i.e. edges without upstands or abutments) to negate the risk of wind uplift or wind scour (as shown in the design details overleaf).

Ballast depths can vary according to the insulation used in some systems. Table 14 sets out typical loadings for roofs insulated with the Polyfoam Slimline system.

For further details on dead and imposed loads refer to BS EN 1991-1-3 : 2006. For wind loads refer to BS EN 1991-1-4:2005+A1: 2010.

Filter layer

A filter layer should be placed between the insulation and ballast layer to prevent fine grit being washed down to the waterproof membrane. The incorporation of the Polyfoam Slimline membrane layer improves the performance of the roofing system by restricting the flow of water below the insulation. This improves the thermal performance of the roof and has the added benefit of reducing the potential for insulation floatation which allows the thickness of the ballast layer to be reduced, thus reducing the overall weight of the roof.

Roof maintenance

As with all other types of roof the inverted/protected membrane roof will benefit from a regular schedule of inspection and routine maintenance. Areas of special concern are the membrane, rainwater outlets, gutters, flashings and other detail work.

The inspection should also include checks to ensure that the insulation and its loading layer are still positioned as installed. Weed growth should be eradicated with a water based weed killer.

Table 14 - Weight and thickness of ballast with Polyfoam Slimline system

| Ballast type | Thickness (mm) | Weight (kg/m ²) |
|----------------|----------------|-----------------------------|
| Gravel | 50 | 80 |
| Concrete slabs | 50 | 125 |

Control of condensation in protected membrane roofs

Because the roof structure and membrane are both kept warm in an inverted/protected membrane roof, the risk of condensation is virtually eliminated. Nevertheless, condensation might occur on the underside of the deck if the deck is thin and has been cooled by water run-off during heavy and continuous rain or melting snow. This condensation will disperse when the heating system overcomes the temperature difference.

To help prevent the condensation from occurring ensure that the deck has a minimum R-value of 0.15 m²K/W. If the deck has a high thermal capacity it will not be rapidly cooled by rainwater. The proposed design should be assessed for condensation risk using the methods and information given in BS 6229: 2003 and BS 5250: 2011.

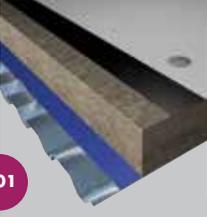
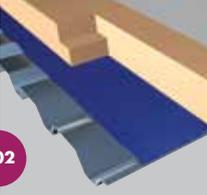
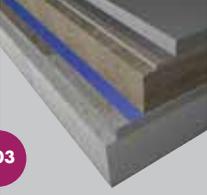
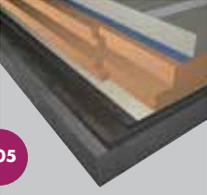
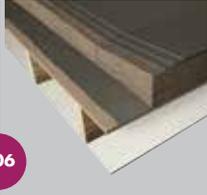
The Polyfoam Slimline system will shed the rainwater to the gutters before it can penetrate through the insulation layer to the waterproofed deck, therefore the condensation risk is considerably reduced if this system is adopted.



Solution optimiser and pathfinder

Key

- Thermal insulation achievable by constructions within this document.
- Pb01 Find online. Visit knaufinsulation.co.uk and key in construction code to find the most up to date information on your chosen solution.

| Knauf Insulation solution | U-values | 0.28 | 0.27 | 0.26 | 0.25 | 0.24 | 0.23 | 0.22 | 0.21 | 0.20 | 0.19 | 0.18 | 0.17 | 0.16 | 0.15 | 0.14 | 0.13 |
|---|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <p>Warm deck single ply membrane Product: Rocksilk Krimpact Flat Roof Slab See page: 96</p>  <p style="text-align: center;">FI01</p> | | | | | | | | | | | | | | | | | |
| <p>Warm deck single ply membrane Product: Polyfoam ECO Roofboard See page: 98</p>  <p style="text-align: center;">FI02</p> | | | | | | | | | | | | | | | | | |
| <p>Warm deck built-up felt/mastic asphalt Product: Rocksilk Krimpact Flat Roof Slab See page: 100</p>  <p style="text-align: center;">FI03</p> | | | | | | | | | | | | | | | | | |
| <p>Protected membrane Products: Polyfoam ECO Roofboard and Polyfoam Slimline membrane See page: 102</p>  <p style="text-align: center;">FI04</p> | | | | | | | | | | | | | | | | | |
| <p>Warm deck car park roof Product: Polyfoam ECO Roofboard Super See page: 104</p>  <p style="text-align: center;">FI05</p> | | | | | | | | | | | | | | | | | |
| <p>Cut-to-falls Product: Rocksilk Krimpact Cut-To-Falls system See page: 106</p>  <p style="text-align: center;">FI06</p> | | | | | | | | | | | | | | | | | |
| <p>Cut-to-falls Product: Polyfoam ECO Cut-To-Falls system See page: 108</p>  <p style="text-align: center;">FI07</p> | | | | | | | | | | | | | | | | | |

Flat roofs

Warm deck single ply membrane



Rocksilk Krimpack Flat Roof Slab



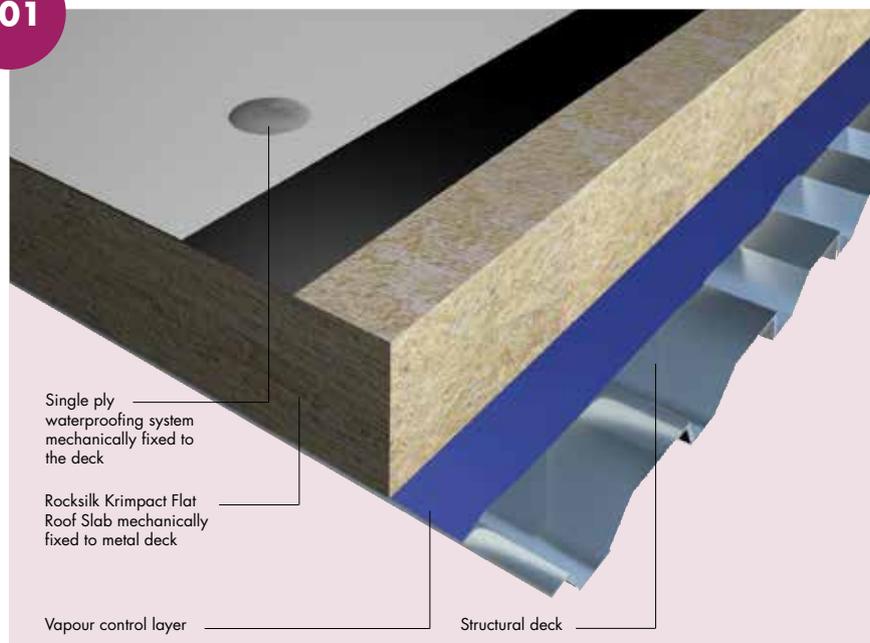
Rocksilk Krimpack Flat Roof Slab

F101

- Significantly improves acoustic performance and reduces the drumming effect of rainwater on lightweight roofs
- Compatible with a wide range of single ply membranes - no requirement for separating layer

Rocksilk Krimpack Flat Roof Slab

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



Products

Rocksilk Krimpack Flat Roof Slab is a high strength, consistent density, rigid, rock mineral wool slab manufactured using Krimpack technology and specifically designed for use in flat roofing.

Rocksilk Krimpack Flat Roof Slab has sufficient compressive strength to be used on warm-deck flat roofs with limited access with concrete, timber or metal decks and subject to light maintenance traffic. If there is a likelihood of more severe traffic occurring, then additional precautions should be considered.

Typical construction

Rocksilk Krimpack Flat Roof Slab is suitable for use on all types of roof deck. The slabs are laid over a vapour control membrane and mechanically fixed to the deck. The insulation is overlaid with a single ply membrane which is mechanically fixed.

Rocksilk Krimpack Flat Roof Slab is compatible with most PVC, EPDM and other types of mechanically fixed single ply waterproofing membrane systems. The advice of the single ply

membrane manufacturer should be sought to confirm compatibility with specific membranes.

Installation

The vapour control layer should be laid over the structural deck and all joints lapped and sealed. Rocksilk Krimpack Flat Roof Slab is then laid in a staggered pattern from one corner of the roof. The orientation of the slabs is unimportant provided the constraints on spanning metal profiled decks are followed. The slabs and membrane should be mechanically fixed to the deck using specialist fixings such as those available from Ejot*. Typically two fixings equally spaced along the length and in the centre of each slab are required to secure the system in place.

*For information on EJOT fixings, contact 01977 687040

Performance

Standards

Rocksilk Krimpack Flat Roof Slab has been tested to the UEAtc Technical Guidelines MOAT No 50: 1992, Thermal insulation systems intended for supporting waterproofing membranes on flat and sloping roofs. It is classified B for mechanical performance – roof

only accessible for purpose of maintenance and may be used without any restrictions.

Compressive resistance

Rocksilk Krimpack Flat Roof Slab has a compressive strength of 60 kPa.

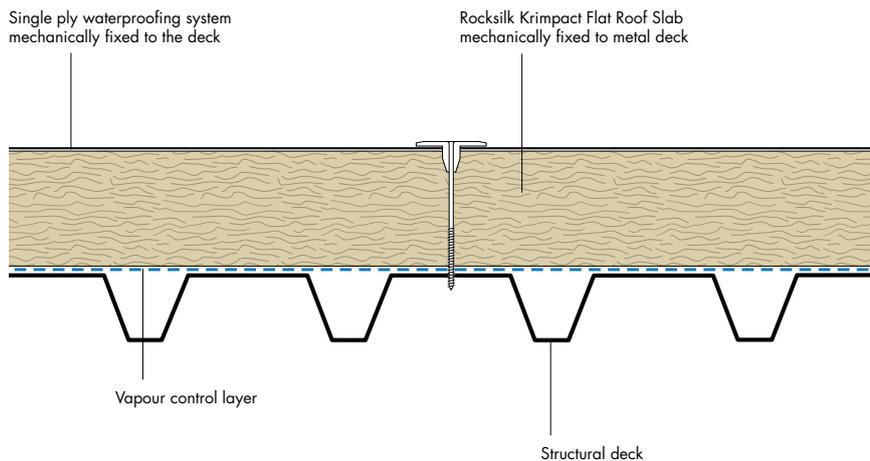
Thermal performance

The thermal conductivity of Rocksilk Krimpack Flat Roof Slab is 0.038 W/mK.

Fire performance

Rocksilk Krimpack Flat Roof Slab is classified as A1 to BS EN 13501-1, the best fire performing insulation. Rocksilk Krimpack Flat Roof Slab has a melting point of over 1000°C. In the event of fire it will emit negligible quantities of smoke and fumes. The heat emission from the product is insignificant.

Typical section



Typical specification

The vapour control layer and Rocksilk Krimpack Flat Roof Slab, thicknessmm to be mechanically fixed to the roof deck.

The single ply membrane should be applied over the insulation in accordance with the appropriate manufacturer's recommended specification.



Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/425.....

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

Table 15 - Typical U-values of warm deck single ply membrane roofs

| Product | Thickness (mm) | U-values (W/m ² K) | | |
|---|------------------|---|---------------------|--|
| | | 150mm concrete 40mm screed 13mm plaster | Profiled metal deck | 19mm chipboard timber joists 12.5mm plasterboard |
| Rocksilk Krimpack Flat Roof Slab | 245 (145+100) | 0.15 | 0.15 | 0.14 |
| | 230 (130+100) | 0.15 | 0.16 | 0.15 |
| | 215 (165+50) | 0.16 | 0.17 | 0.16 |
| | 200 (2x100) | 0.17 | 0.19 | 0.17 |
| | 180 (100+80) | 0.19 | 0.21 | 0.19 |
| | 165 | 0.21 | 0.22 | 0.20 |
| | 150 | 0.22 | 0.24 | 0.22 |
| | 140 | 0.24 | 0.26 | 0.24 |
| | 130 | 0.25 | 0.28 | 0.25 |



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

Flat roofs

The profiles of metal deck roofs need to provide sufficient support for the insulation. The greater the thickness of insulation, the greater the span it can accommodate on profiled metal decks.

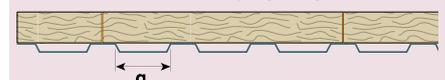
Where the butt joint of Krimpack Flat Roof Slabs occurs along the top of the profiles then the maximum allowable span is (a), as shown in the table. Where the butt joint occurs over the troughs of the profiles then the maximum allowable span is (b), as shown in the table.

Note: Polyfoam ECO Roofboard will perform at least as well as Rocksilk Krimpack Flat Roof Slab.

Table 16 - Maximum allowable span

| Insulation thickness (mm) | Max span a (mm) | Max span b (mm) |
|---------------------------|-----------------|-----------------|
| 50 | 170 | 120 |
| 60 | 180 | 140 |
| 70 | 200 | 160 |
| 75 | 210 | 170 |
| 80 | 220 | 180 |
| 160 | 220 | 200 |

Insulation slabs butt along tops of profiles



Insulation slabs butt over troughs



Flat roofs

Warm deck single ply membrane

Polyfoam ECO Roofboard Extra



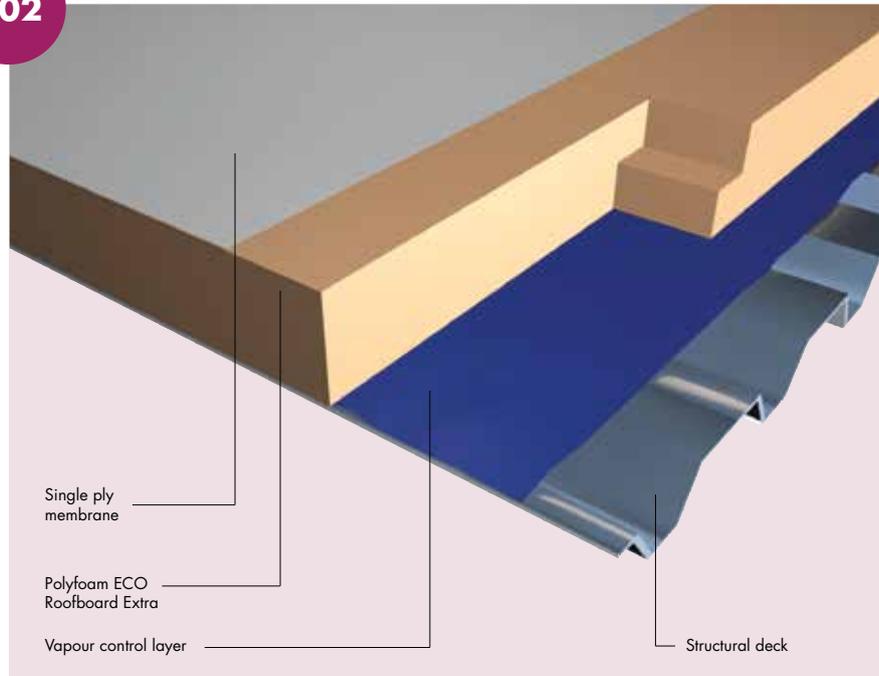
Polyfoam ECO Roofboard


F102

- Light, strong, moisture resistant with a high compressive strength
- Compressive strength allows light roof traffic and offers future use potential
- Rebated edges provide support across spans in profiled roof decks

Polyfoam ECO Roofboard Extra

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Roofboard Extra is 100% ozone friendly, extruded polystyrene, rigid board insulation it is lightweight, yet has excellent structural strength and long term effectiveness.

Polyfoam ECO Roofboard Extra has a Global Warming Potential (GWP) of less than 5.

It is supplied with interlocking rebated edges and is suitable for lightly trafficked flat roofs.

Polyfoam ECO Roofboard Extra is for use in medium trafficked flat roofs and in green and garden roofs.

Typical construction

Polyfoam ECO Roofboard Extra is suitable for use on all types of roof deck. The boards are laid over a vapour control layer and either mechanically fixed or bonded to the vapour control layer.

The insulation is overlaid with a single ply membrane which can be fully adhered to the insulation or mechanically fixed to the deck.

When using partially or fully bonded membrane systems, Polyfoam ECO Roofboard Extra should be mechanically fixed to the deck to withstand the calculated wind load. The waterproof membrane may then be bonded to the insulation using a polyurethane based adhesive in accordance with the membrane manufacturer's instructions. The advice of the waterproofing membrane manufacturer will be required for the precise fixing specification.

When using mechanically fixed membranes, Polyfoam ECO Roofboard Extra should be mechanically fixed to the deck.

Polyfoam ECO Roofboard Extra is suitable for use with most PVC membranes (provided there is a separation layer between the board and membrane), EPDM and other types of single ply waterproof membranes. The advice of the single ply membrane manufacturer should be sought to confirm compatibility with specific membranes.

Installation

The vapour control layer should be laid over the structural deck and all joints lapped and sealed. If a PVC membrane is being used, a suitable separating layer should be installed.

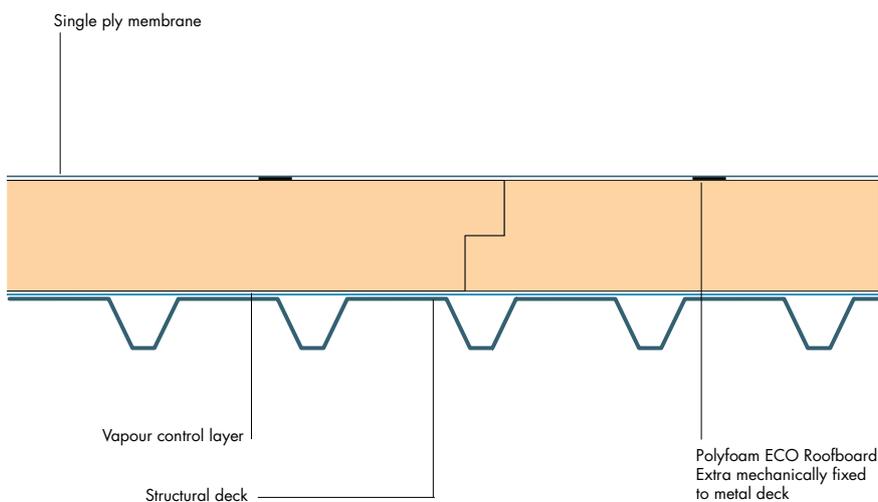
The boards are then laid in a staggered pattern from one corner of the roof.

In a bonded membrane system, each layer of Polyfoam ECO Roofboard Extra must be bonded as well as the waterproof membrane itself. A polyurethane based adhesive is recommended.

When a mechanically fixed membrane is being used, Polyfoam ECO Roofboard Extra should be mechanically fixed to the deck with two centrally placed fixings in each board to secure the boards in place before the membrane is fixed.

When installing double layers of Polyfoam ECO Roofboard Extra, the second layer should be installed transversely to the first layer in order to minimise the number of coincident joints between the insulation boards. If required, one centrally placed mechanical fixing can be installed in the first layer prior to the installation and final fixing of the second layer. Both insulation layers should be laid in a staggered stretcher brick bond pattern.

Polyfoam ECO Roofboard Extra below a mechanically fixed single ply membrane



Typical specification

The vapour control layer and Polyfoam ECO Roofboard Extra,mm thick, to be mechanically fixed*/adhered* to the roof deck.

The single ply membrane should be installed over the insulation in accordance with the appropriate manufacturer's recommended specification.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/415.....

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

Performance

Thermal performance

Polyfoam ECO Roofboard Extra, has a thermal conductivity of 0.033 W/mK.

Compression resistance

Polyfoam ECO Roofboard Extra is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and deadloads with creating excessive deflection.

Moisture resistance

Polyfoam ECO Roofboard Extra is highly resistant to moisture and can be laid in standing water or up against wet concrete with negligible impact on the performance of the product.

Fire performance

When Polyfoam ECO Roofboard Extra is installed in a roof construction it will not contribute to the development stages of a fire.

Table 17 - Typical U-values of warm deck single ply membrane roofs

| Product | Thickness (mm) | U-values (W/m ² K) | | |
|-------------------------------------|-------------------|---|---------------------------|--|
| | | 150mm concrete 40mm screed 13mm plaster | Profiled metal deck | 19mm chipboard timber joists 12.5mm plasterboard |
| Polyfoam ECO Roofboard Extra | | | | |
| | 200 (2x100) | 0.16 | 0.16 | 0.15 |
| | 190 (100+90) | 0.17 | 0.17 | 0.16 |
| | 180 (100+80) | 0.18 | 0.18 | 0.17 |
| | 170 (100+70) | 0.19 | 0.19 | 0.18 |
| | 160 | 0.21 | 0.21 | 0.20 |
| | 150 (80+70) | 0.22 | 0.23 | 0.21 |
| | 140 | 0.23 | 0.24 | 0.22 |
| | 130 (70+60) | 0.25 | 0.26 | 0.24 |



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

CERTIFICATE CS1001-2
U Value Competency Scheme

Flat roofs

Warm deck built-up felt/mastic asphalt



Rocksilk Krimpack Flat Roof Slab



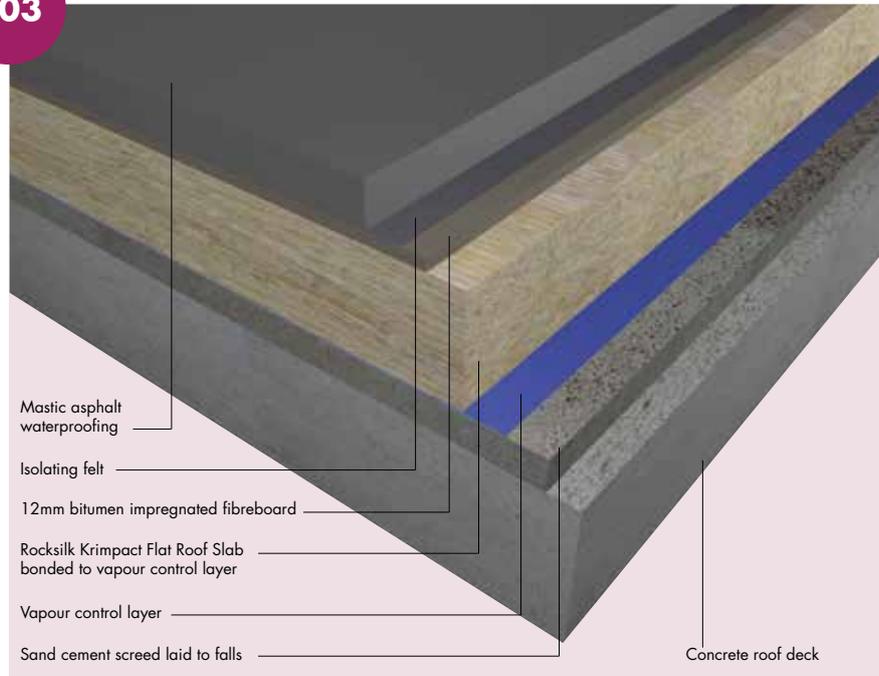
Rocksilk Krimpack Flat Roof Slab

F103

- Insulation slabs knit together at joints, reducing the potential for cold spots and loss of thermal performance
- Quick to install and dimensionally stable
- Compatible with a wide range of weatherproofing systems

Rocksilk Krimpack Flat Roof Slab

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



Products

Rocksilk Krimpack Flat Roof Slab is a high strength, consistent density, rigid, rock mineral wool slab manufactured using Krimpack Technology and specifically designed for use in flat roofing.

Rocksilk Krimpack Flat Roof Slab has sufficient compressive strength to be used on warm-deck flat roofs with limited access with concrete, timber or metal decks and subject to light maintenance traffic. If there is a likelihood of more severe traffic occurring, then additional precautions should be considered.

Typical construction

Rocksilk Krimpack Flat Roof Slab is suitable for use on all types of roof deck. The insulation slabs are laid staggered bond, butt jointed and bonded to the deck. The insulation is overlaid with a waterproof membrane consisting of either a fully bonded built-up bitumen roofing system, or mastic asphalt. When used with

mastic asphalt, the insulation is overlaid with 12mm bitumen impregnated fibreboard and an isolating felt.

Installation

The vapour control layer and Rocksilk Krimpack Flat Roof Slab are both fully bonded in hot bitumen and then waterproofed.

Built-up felt membranes

High performance bitumen membrane systems are fully bonded in hot bitumen to the Rocksilk Krimpack Flat Roof Slab using traditional roll and pour methods. Rocksilk Krimpack Flat Roof Slab is not suitable for the direct application of torch-on roofing felts.

Mastic asphalt surface

Rocksilk Krimpack Flat Roof Slab provides a stable base for mastic asphalt. The slabs should be overlaid with a 12mm layer of bitumen impregnated fibreboard. A bitumen felt (low grade is satisfactory) should be loose laid

without bonding onto the fibreboard prior to the application of the mastic asphalt.

Performance

Standards

Rocksilk Krimpack Flat Roof Slab has been tested to the UEAtc Technical Guidelines MOAT No 50: 1992, Thermal insulation systems intended for supporting waterproofing membranes on flat and sloping roofs. It is classified B for mechanical performance – roof only accessible for purpose of maintenance and may be used without any restrictions.

Thermal performance

The thermal conductivity of Rocksilk Krimpack Flat Roof Slab is 0.038 W/mK.

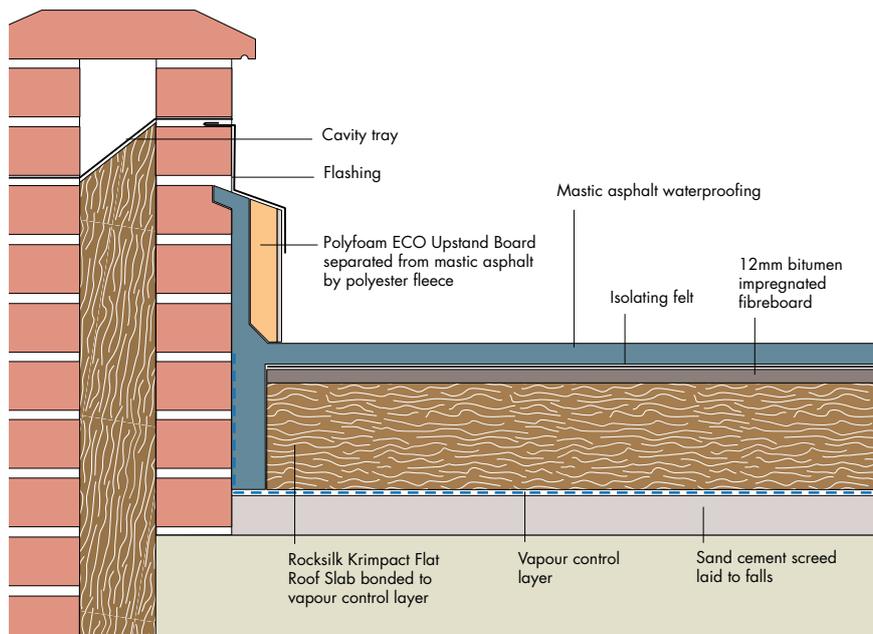
Compressive resistance

Rocksilk Krimpack Flat Roof Slab has a compressive strength of 60 kPa.

Fire performance

Rocksilk Krimpack Flat Roof Slab is classified as Euroclass A1 to BS EN 13501-1. Rocksilk products have a melting point of over 1000°C. In the event of fire they will emit negligible quantities of smoke and fumes. The heat emission from the products is insignificant.

Typical parapet



Typical specification

The vapour control layer and Rocksilk Krimpack Flat Roof Slab,.....mm thick to be fully bonded, with hot bitumen.

The waterproof membrane should be applied in accordance with the appropriate manufacturer's recommended specification.

Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/425.....

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

Table 18 - Typical U-values of flat roofs insulated with Rocksilk Krimpack Flat Roof Slab

| Thickness (mm) | U-values (W/m ² K) | | |
|-------------------|---|---------------------|--|
| | 150mm concrete screed 40mm 13mm plaster | Profiled metal deck | 19mm chipboard timber joists 12.5mm plasterboard |
| 245 (145+100) | 0.15 | 0.15 | 0.14 |
| 230 (130+100) | 0.15 | 0.16 | 0.15 |
| 215 (165+50) | 0.16 | 0.17 | 0.16 |
| 200 (2x100) | 0.17 | 0.19 | 0.17 |
| 180 (100+80) | 0.19 | 0.21 | 0.19 |
| 165 | 0.21 | 0.22 | 0.20 |
| 150 | 0.22 | 0.24 | 0.22 |
| 140 | 0.24 | 0.26 | 0.24 |
| 130 | 0.25 | 0.28 | 0.25 |



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

Flat roofs

Protected membrane

Polyfoam ECO Roofboard Extra



Polyfoam Slimline System

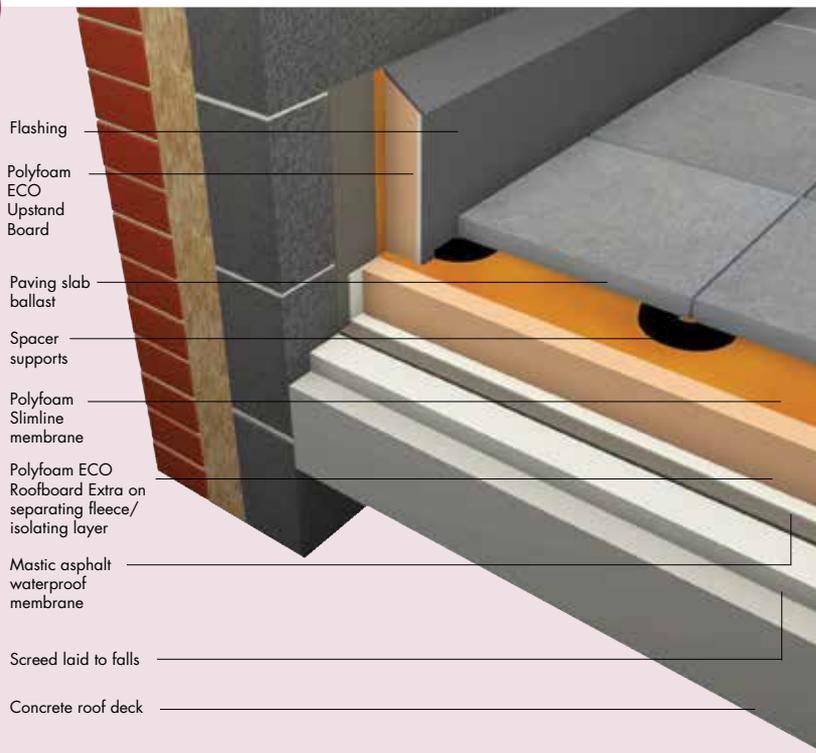


F104

- High compressive strength of Polyfoam ECO Roofboard Extra supports loading of paving slab supports
- Polyfoam Slimline system enables a thinner layer of insulation to achieve the specified U-value
- Protected membrane flat roofs using the Polyfoam Slimline system are lighter as less ballast is required

Polyfoam ECO Roofboard Extra

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Roofboard Extra is a 100% ozone friendly, extruded polystyrene, rigid insulation board that is lightweight, yet has excellent structural strength and moisture resistance.

Polyfoam ECO Roofboard Extra has a Global Warming Potential (GWP) of less than 5.

Polyfoam Slimline membrane is a high performance, non woven polypropylene geotextile membrane that prevents the passage of water and is water vapour permeable.

Polyfoam ECO Upstand Board is a laminate of Polyfoam ECO extruded polystyrene, rigid board insulation and a tough, weather resistant facing board suitable for exterior use.

Typical construction

Protected membrane roof with ballast of gravel or paving slabs and the Polyfoam Slimline membrane in place of the standard filtration membrane. Polyfoam Slimline membrane:

- is water resistant, preventing cold rainwater reaching the waterproof membrane and so improving thermal performance
- allows water vapour from below to permeate

the membrane

- reduces flotation, so less ballast is required

Installation

The waterproofing membrane is laid on the roof deck in accordance with manufacturers instructions. The waterproofing membrane can be either reinforced bitumen, polymeric single ply, mastic asphalt or hot melt waterproofing system.

The waterproof membrane must be free of loose gravel and grit before the insulation boards are laid.

On existing roofs, any existing chippings should be covered with a polyethylene cushion layer, such as Floorfoam.

For all mastic asphalt applications, a separating non woven polyester fleece is required – as defined in BS 8218:1998. For PVC single ply membranes, a similar fleece or other approved separating layer, should be laid immediately below the insulation and turned up at all upstands to the top of any upstand insulation to isolate Polyfoam ECO Roofboard Extra from the waterproofing layer. If in doubt regarding the compatibility of the insulation and membrane contact Knauf Insulation Technical Advice and

Support Centre or the membrane manufacturer.

Polyfoam ECO Roofboard Extra should be laid in a staggered pattern from the point of access across the roof. It is important that all joints between boards are tight fitting and there are no gaps at the junctions with rooflights, upstands etc.

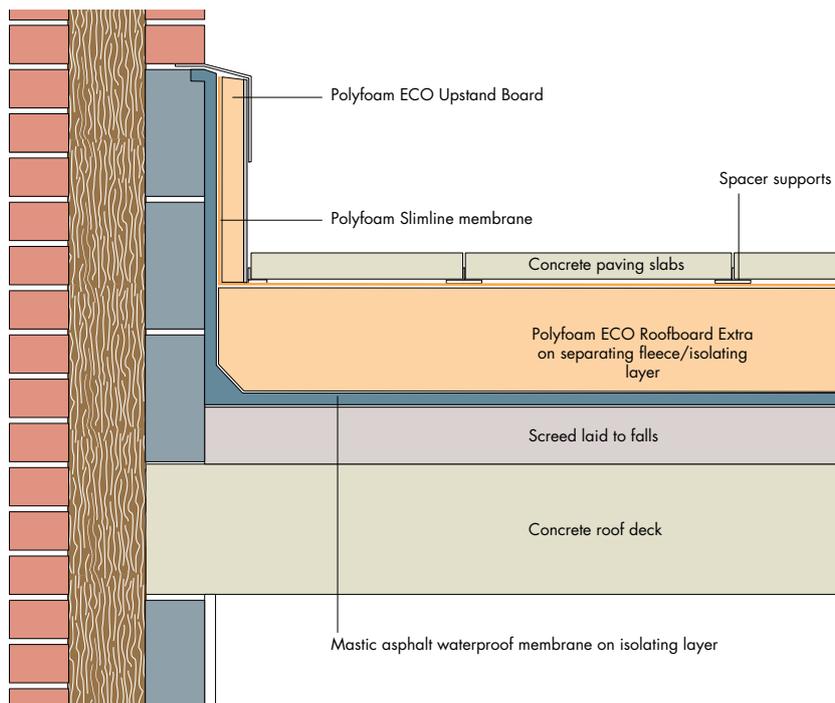
Polyfoam Slimline membrane is loose laid over the insulation, at right angles to the slope, with 300mm side laps. At all upstands and penetrations, turn the membrane up so it finishes above the ballast level.

Gravel ballast is laid (using 20-40mm diameter gravel at 50mm depth) to prevent wind uplift. To create a roof terrace/patio area, paving slabs at 50mm thick are an alternative to gravel ballast.

Each layer is laid on an advancing front in order to protect the membrane from mechanical damage as the materials are transported across the roof.

At upstands, fix Polyfoam ECO Upstand Board to the abutment using a suitable mechanical fixing or adhesive. Ensure the top exposed edge of insulation is protected from UV degradation using a suitable UV resistant

Typical detail with concrete paving ballast



Typical specification

The whole of the roof area, lined with a waterproof membrane to be insulated with Polyfoam ECO Roofboard Extramm thick. The insulation to be overlaid with Polyfoam Slimline membrane and covered with gravel ballast.*/minimum 50mm thick paving slabs on spacers*.

(*Delete as required.)

The gravel to be washed, rounded and graded, free from sand and grit with a nominal diameter of 20 to 40mm and a minimum of 50mm deep.



Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/415.....

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

flashing.

Performance

Compression resistance

Polyfoam ECO Roofboard Extra is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

The facing of Polyfoam ECO Upright Board is highly resistant to impact damage and provides a robust finish.

Moisture resistance

Polyfoam ECO Roofboard Extra is highly resistant to moisture and can be laid in standing water or up against wet concrete with negligible impact on the performance of the product.

The facing of Polyfoam ECO Upright Board is moisture resistant.

Thermal performance

Polyfoam ECO Roofboard Extra has a thermal conductivity of 0.033 W/mK.

The extruded polystyrene content of Polyfoam ECO Upright Board has a thermal conductivity

of 0.033 W/mK.

Fire performance

When Polyfoam ECO Roofboard Extra is installed in a roof construction it will not contribute to the development stages of a fire.

Polyfoam ECO Upright Board is faced with a

6mm weather resistant board which offers excellent fire performance as a facing material.

The facing board is classified as Class 1 Surface Spread of Flame to BS 476: Part 7: 1987.

Table 19 - Typical U-values of protected membrane roofs using Polyfoam Slimline System

| Product | Thickness (mm) | U-values (W/m ² K) |
|-------------------------------------|-------------------|---|
| | | 150mm concrete 40mm screed 13mm plaster |
| Polyfoam ECO Roofboard Extra | 240 (140 +100) | 0.14 |
| | 220 (120+100) | 0.15 |
| | 200 (2 x100) | 0.16 |
| | 180 (100+80) | 0.18 |
| | 170 (100 +70) | 0.19 |
| | 160 | 0.21 |
| | 150 (80+70) | 0.22 |
| | 140 | 0.24 |
| | 130 (70+60) | 0.26 |



Note: For project specific calculations contact our Technical Advice and Support Centre on 01744 766666.

Technical Advice and Support Centre 01744 766666 www.knaufinsulation.co.uk

Flat roofs

Warm deck car park roof

Polyfoam ECO Roofboard Super



Polyfoam ECO Roofboard

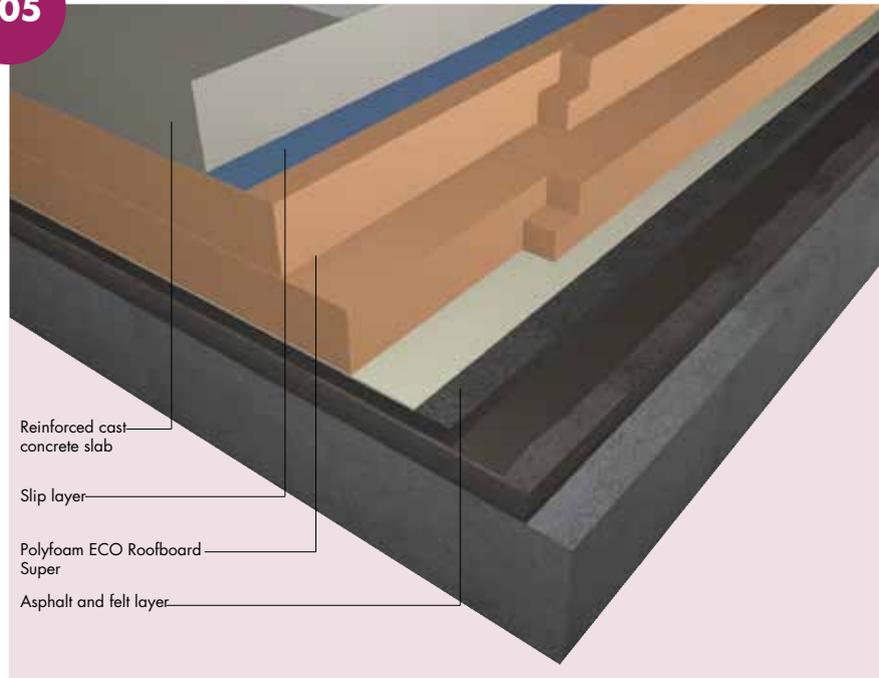


F105

- Lightweight, very strong, and moisture resistant
- High level of compressive strength to support the loads associated with a car park roof
- Protects waterproofing membrane during concrete casting, increasing its in service life

Polyfoam ECO Roofboard Super

- BBA certified
- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Roofboard Super is a 100% ozone friendly, extruded polystyrene, rigid board insulation. It is lightweight, yet has excellent structural strength and long term effectiveness.

Polyfoam ECO Roofboard Super has a Global Warming Potential (GWP) of less than 5.

Typical construction

A structural concrete deck designed as a waterproof car park roof. Polyfoam ECO Roofboard Super is installed on top of the waterproof layer and then covered with a structural reinforced concrete slab to withstand heavy loading and traffic.

Installation

Cover the whole of the roof deck with a waterproofing layer. Lay Polyfoam ECO Roofboard Super onto this layer (using a non woven polyester fleece separation layer if the waterproofing layer is PVC based or asphalt). Stagger the joints of the boards and ensure the interlocking rebates are tightly pushed together.

Cover the insulation with a slip layer and a reinforced cast concrete slab designed to withstand the expected load of vehicle traffic.

Finish slab as required for car park deck.

Performance

Compression resistance

All materials are compressed under load. If the roof is going to be transformed from a limited access waste of space into a useful space the insulation must be capable of accommodating applied loads.

Polyfoam ECO Roofboard Super is highly resistant to compression and withstands both occasional and long term static loads. Load bearing construction elements should be designed to adequately support the combination of imposed and dead loads without creating excessive deflection.

Moisture resistance

Polyfoam ECO Roofboard Super is highly resistant to moisture and can be laid in standing water or up against wet concrete with negligible impact on the performance of the product.

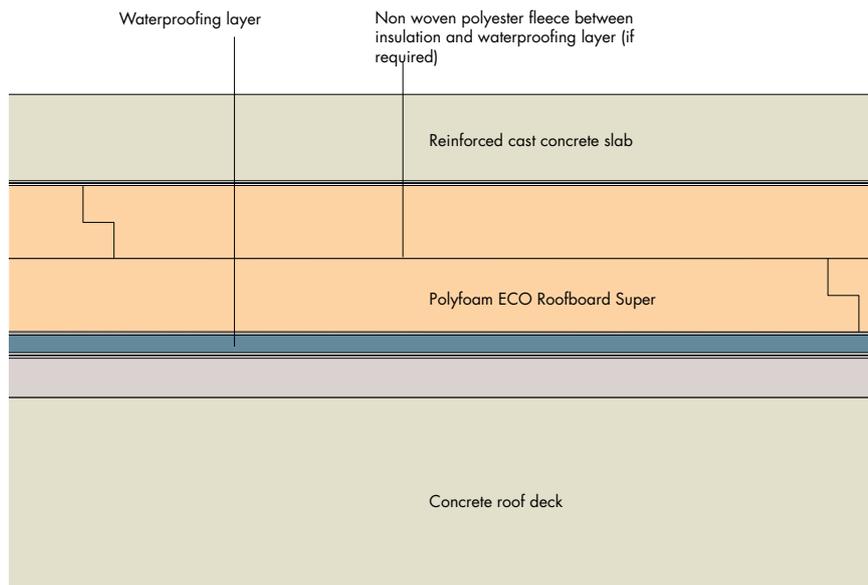
Thermal performance

The thermal conductivity of Polyfoam ECO Roofboard Super is 0.034 or 0.036 W/mK.

Fire performance

When Polyfoam ECO Roofboard Super is installed in a roof construction it will not contribute to the development stages of a fire.

Typical section



Typical specification

The whole roof area to be covered with a waterproofing layer and insulated with Polyfoam ECO Roofboard Supermm thick. The insulation to be covered with amm reinforced concrete slab. Finish slab as required for car park deck.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses... J42/415.....

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

Table 20 - Typical U-values of car park roofs

| Product | Thickness (mm) | U-values (W/m ² K) |
|-------------------------------------|-------------------|---|
| | | 150mm concrete 40mm screed 13mm plaster |
| Polyfoam ECO Roofboard Super | | |
| | 240 (3x80) | 0.14 |
| | 220 (100+2x60) | 0.15 |
| | 200 (2x100) | 0.17 |
| | 180 (100+80) | 0.19 |
| | 160 (2x80) | 0.21 |
| | 140 (80+60) | 0.23 |
| | 120 (2x60) | 0.26 |



Note: Assumed finish of 100mm cast concrete slab.
For project specific calculations contact our Technical Advice and Support Centre on 01744 766666

Flat roofs

Cut-To-falls

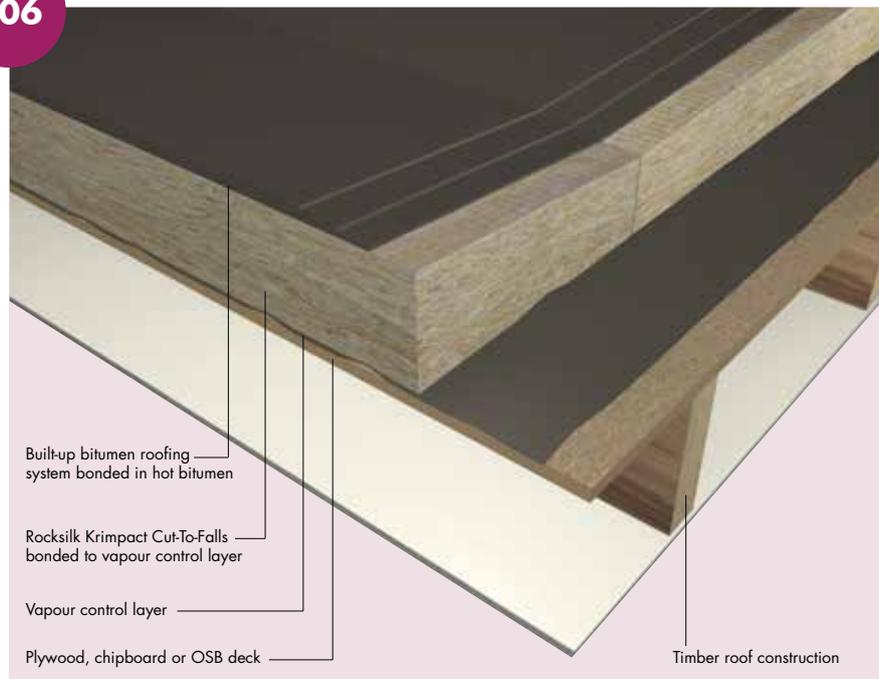
Rocksilk Krimpack Flat Roof Slab


F106

- Insulation slabs knit together at joints, reducing the potential for cold spots and loss of thermal performance
- Bespoke system supported by specialist design service to meet the needs of each individual project
- Compatible with a wide range of single ply membranes - no requirement for separating layer

Rocksilk Krimpack Cut-To-Falls

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



Products

Rocksilk Krimpack Cut-To-Falls is a system of tapered, pre-cut, compression resistant insulation slabs made from rock mineral wool. The slabs are supplied pre-cut to the required falls, normally 1:60 or 1:40 (BS 6229 requires a minimum fall of 1:80 to be achieved on built-up roofs) so normal practice is to design at a greater fall to allow for deflection of the deck or other site problems.

Typical construction

Rocksilk Krimpack Cut-To-Falls is suitable for use on all types of roof deck. The insulation slabs are laid over and fully bonded to a vapour control layer which is bonded to the roof deck. The insulation is overlaid with a waterproof membrane consisting of either a fully bonded built-up bitumen roofing system, a single ply membrane or mastic asphalt. When used with mastic asphalt, the insulation is overlaid with 12mm bitumen impregnated fibreboard and an isolating felt.

Installation

Rocksilk Krimpack Cut-To-Falls slabs are numbered and supplied with a laying scheme for the individual roof in accordance with drawings supplied by the client. Rocksilk Krimpack Cut-To-Falls is not just a product but a comprehensive service from design to delivery.

Timber decks

The vapour barrier can be either nailed to the timber deck as defined in BS 8217: 2005, or bitumen bonded using traditional techniques.

Built-up felt membranes

High performance bitumen membrane systems are fully bonded in hot bitumen to the Rocksilk Cut-To-Falls slabs using traditional roll and pour methods.

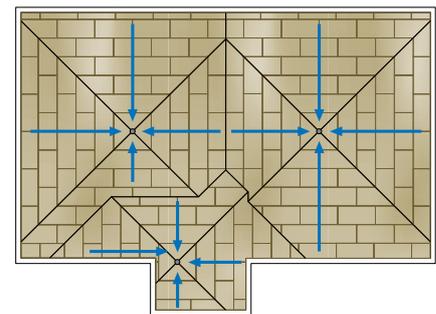
Mastic asphalt surface

Rocksilk Cut-To-Falls slabs provide a stable base for mastic asphalt. The slabs should be overlaid with a 12mm layer of bitumen impregnated fibreboard. A bitumen felt (low grade is satisfactory) should be loose laid without bonding onto the fibreboard prior to the application of the mastic asphalt.

Single ply membranes

These should be fixed in accordance with the manufacturer's recommendations.

Typical example of cut-to-falls plan and roof drainage outlets



Performance

Standards

Rocksilk Krimpack Cut-To-Falls has been tested to the UEAtc Technical Guidelines MOAT No 50: 1992, Thermal insulation systems intended for supporting waterproofing membranes on flat and sloping roofs. It is classified B for mechanical performance – roof only accessible for purpose of maintenance and may be used without any restrictions.

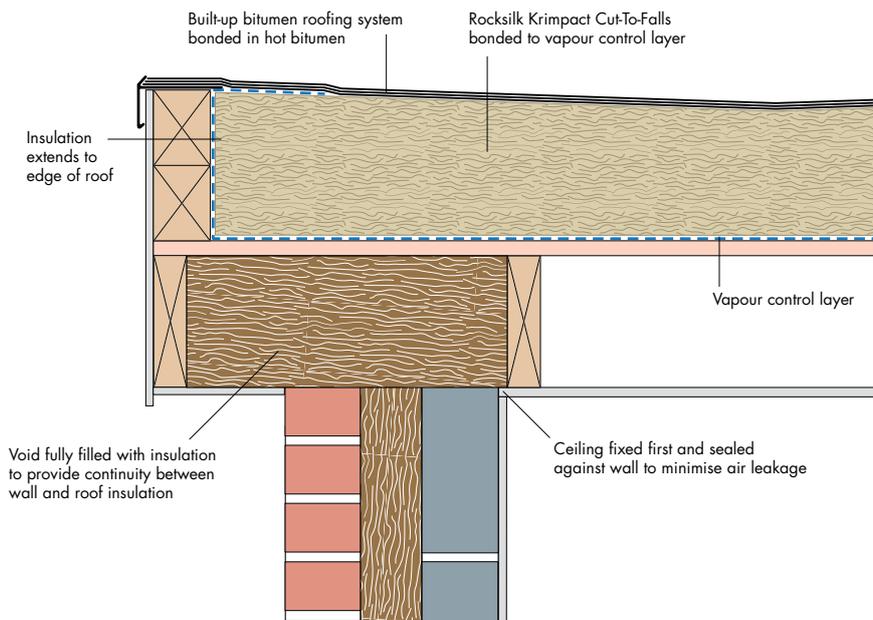
Compressive resistance

Rocksilk Krimpack Cut-To-Falls has a compressive strength of 60 kPa.

Thermal performance

The thermal conductivity of Rocksilk Krimpack Cut-To-Falls is 0.038 W/mK.

Typical verge detail



Typical specification

The vapour control layer and RocksilK Krimpack Cut-To-Fallsmm thick to be fully bonded with hot bitumen. RocksilK Krimpack Cut-To-Falls should be laid in accordance with the laying scheme supplied. The waterproof membrane should be applied in accordance with the appropriate manufacturer's recommended specification.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses... J41/425.....

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

Table 26 shows the U-values achieved for typical constructions insulated with various thicknesses of RocksilK Cut-To-Falls slabs. Because the thickness of insulation varies across the entire roof in cut to falls schemes, the U-value varies across the whole roof, being best and worse where the greatest and least thickness of insulation occurs, respectively. Every scheme is different and the average U-value for the entire roof can only be calculated when the scheme of falls has been designed. The cut to falls scheme designer will then set the minimum thickness so that the average U-value for the entire roof meets the design or Building Regulations requirements. This table is a useful reference to determine what the highest possible minimum thickness of insulation would be to achieve a specific U-value, in reality it will be less. The thermal performance of a cut-to-falls roof is based on the overall U-value of the roof system, which is a function of the individual tapers and the respective areas as detailed in BS 6946:2007.

Fire performance

RocksilK Cut-To-Falls is classified as Euroclass A1 to BS EN 13501-1, this is the highest fire rating possible for an insulation product to achieve. RocksilK products have a melting point of over 1000°C. In the event of fire they

Table 21 - Typical U-values of cut to falls flat roofs

| Product | Thickness (mm) | U-values (W/m ² K) | | |
|---------------------------------------|-------------------|---|---------------------------|--|
| | | 150mm concrete 40mm screed 13mm plaster | Profiled metal deck | 19mm chipboard timber joists 12.5mm plasterboard |
| RocksilK Krimpack Cut-To-Falls | | | | |
| | 245 | 0.15 | 0.15 | 0.14 |
| | 230 | 0.16 | 0.16 | 0.15 |
| | 215 | 0.17 | 0.17 | 0.16 |
| | 205 | 0.17 | 0.18 | 0.17 |
| | 190 | 0.19 | 0.19 | 0.18 |
| | 180 | 0.20 | 0.21 | 0.19 |
| | 170 | 0.21 | 0.22 | 0.20 |
| | 160 | 0.22 | 0.23 | 0.21 |
| | 150 | 0.23 | 0.24 | 0.22 |
| | 145 | 0.24 | 0.25 | 0.23 |

BBA
CERTIFICATE 08/000012
U Value Competency Scheme

Note: U-value calculations based on the installation of a single ply membrane and are calculated for the specific indicated thickness of RocksilK Krimpack Cut-to-Falls Slab.

will emit negligible quantities of smoke and fumes. The heat emission from the products is insignificant.

For general technical enquiries on cut to falls roofing, contact the Knauf Insulation Technical

Advice and Support Centre on 01744 766666. For a quotation on a specific project please contact Knauf Insulation Sales on 0844 800 0135.

Flat roofs

Cut-To-falls

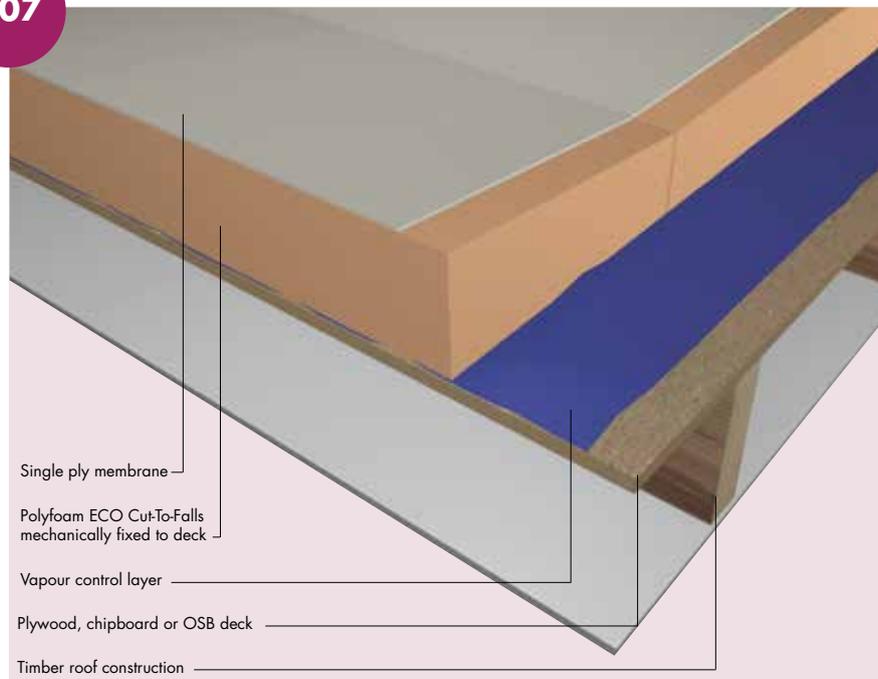
Polyfoam ECO Cut-to-Falls


F107

- Lightweight, strong, and moisture resistant
- Bespoke system supported by specialist design service to meet the needs of each individual project
- High compressive strength allows roof traffic and offers future use potential

Polyfoam ECO Cut-to-Falls

- Zero Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP) <5



Products

Polyfoam ECO Cut-To-Falls is a specially designed system of pre-cut, tapered, 100% ozone friendly, extruded polystyrene rigid board insulation. The boards are supplied pre-cut to the required falls, though most are either 1:40 or 1:60 (BS 6229 requires a minimum fall of 1:80 to be achieved on built-up roofs) so normal practice is to design at a greater fall to allow for deflection of the deck or other site problems.

Polyfoam ECO Cut-To-Falls has a Global Warming Potential (GWP) of less than 5.

Typical construction

Polyfoam ECO Cut-To-Falls boards are suitable for use on all types of roof deck.

The boards are laid over a vapour control layer and mechanically fixed or bonded to the deck.

The insulation is overlaid with a single ply membrane which can be fully adhered to the insulation or mechanically fixed to the deck.

When using partially or fully bonded membrane systems, Polyfoam ECO Cut-To-Falls boards should be mechanically fixed to the deck to withstand the calculated wind load.

The waterproof membrane may then be bonded to the insulation using a polyurethane based adhesive in accordance with the membrane manufacturer's instructions. The advice of the waterproofing membrane manufacturer will be required for the precise fixing specification.

When using mechanically fixed membranes, Polyfoam ECO Cut-To-Falls boards should be mechanically fixed to the deck.

Polyfoam ECO Cut-To-Falls is suitable for use with most PVC membranes (providing there is a separation layer between the board and the membrane), EPDM and other types of single ply waterproof membrane systems. The advice of the single ply membrane manufacturer should be sought to confirm compatibility with specific membranes.

Installation

The vapour control layer should be laid over the structural deck and all joints lapped and bonded. Polyfoam ECO Cut-To-Falls boards are numbered and supplied with a laying scheme for their application.

Each component will be marked on the diagram and should be laid as indicated starting at, and working away from, the drainage outlet.

In a bonded membrane system, each layer of the Polyfoam ECO Cut-To-Falls scheme must

be bonded as well as the waterproof membrane itself.

When a mechanically fixed membrane is being used, the Polyfoam ECO Cut-To-Falls boards should be mechanically fixed to the deck with two centrally placed fixings in each board to secure the boards in place before the membrane is fixed.

Performance

Compression resistance

Polyfoam ECO Cut-To-Falls is highly resistant to compression and can be specified to withstand both occasional and long term static loads.

Moisture resistance

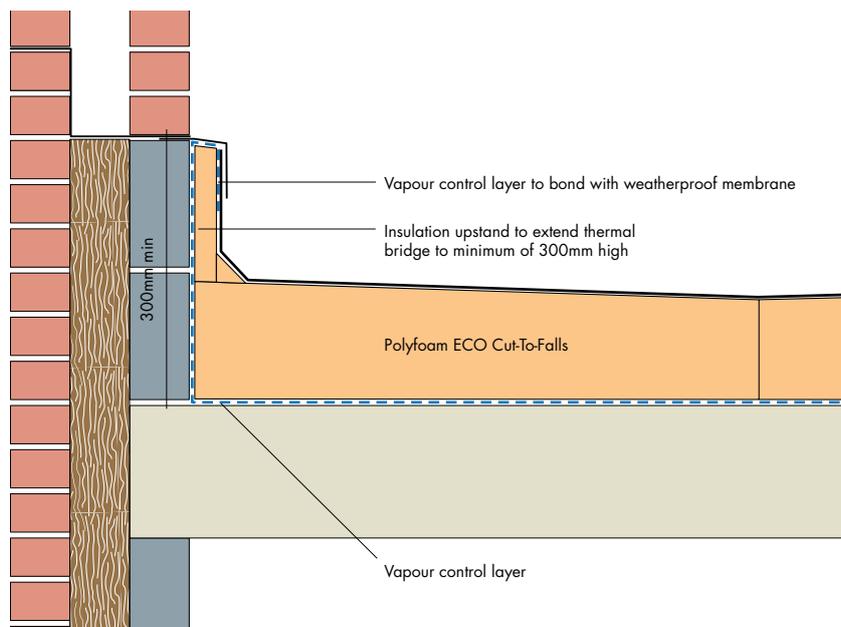
Polyfoam ECO Cut-To-Falls boards are resistant to moisture absorption and can be laid in standing water or up against wet concrete with negligible impact on the performance of the product.

Thermal performance

Polyfoam ECO Cut-To-Falls has a thermal conductivity of 0.033 W/mK.

Table 22 (right) shows the U-value achieved for typical constructions insulated with various thicknesses of Polyfoam ECO Cut-To-Falls products. Because the thickness of insulation varies across the entire roof in cut to falls schemes the U-value varies across the whole

Typical abutment detail with concrete deck



Typical specification

The vapour control layer and Polyfoam ECO Cut-To-Falls to be mechanically fixed*/adhered* to the roof deck.

(*delete as required)

Polyfoam ECO Cut-To-Falls should be laid in accordance with the laying scheme supplied.

The waterproof membrane should be applied in accordance with the appropriate manufacturer's recommended specification.

nbsPlus

Alternatively, consult the National Building Specifications, Standard version clause/clauses...

J42/415.....

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

roof, being best and worse where the greatest and least thickness of insulation occurs respectively. Every scheme is different and the average U-value for the entire roof can only be calculated when the scheme of falls has been designed. The cut-to-falls scheme designer will then set the minimum thickness so that the average U-value for the entire roof meets the design or Building Regulations requirements.

This table is a useful reference to determine what the highest possible minimum thickness of insulation would be to achieve a specific U-value, in reality it will be less.

The thermal performance of a cut-to-falls roof is based on the overall U-value of the roof system, which is a function of the individual tapers and the respective areas as detailed in BS 6946:2007.

Fire performance

When Polyfoam ECO Cut-To-Falls is installed in a roof construction it will not contribute to the development stages of a fire. When overlaid with a single ply membrane the performance of the finished roof will depend on the membrane used. Please consult the membrane supplier for further details.

Table 22 - Typical U-values of flat roofs insulated with Polyfoam ECO Cut-To-Falls

| Product | Thickness (mm) | U-values (W/m ² K) | | |
|----------------------------------|-------------------|---|---------------------------|--|
| | | 150mm concrete 40mm screed 13mm plaster | Profiled metal deck | 19mm chipboard timber joists 12.5mm plasterboard |
| Polyfoam ECO Cut-To-Falls | | | | |
| | 230 | 0.15 | 0.15 | 0.14 |
| | 220 | 0.16 | 0.16 | 0.15 |
| | 210 | 0.16 | 0.17 | 0.16 |
| | 200 | 0.17 | 0.18 | 0.16 |
| | 190 | 0.18 | 0.18 | 0.17 |
| | 180 | 0.19 | 0.19 | 0.18 |
| | 170 | 0.20 | 0.21 | 0.19 |
| | 160 | 0.21 | 0.22 | 0.20 |
| | 150 | 0.23 | 0.23 | 0.21 |
| | 140 | 0.24 | 0.25 | 0.23 |
| | 130 | 0.26 | 0.27 | 0.24 |



Note: U-value calculations based on the installation of a single ply membrane and are calculated for the specific indicated thickness of Polyfoam ECO Roofboard Extra.

For general technical enquiries on cut-to-falls roofing, contact the Knauf Insulation Technical Advice and Support Centre on 01744 766666. For a quotation on a specific project please contact Knauf Insulation Sales on 0844 800 0135.

Knauf Insulation Ltd
PO Box 10
Stafford Road
St Helens
Merseyside
WA10 3NS

Customer Service (Sales)
Tel: 0844 800 0135
Fax: 01744 612007
Email: sales.uk@knaufinsulation.com
www.knaufinsulation.co.uk

Technical Advice and Support Centre
Tel: 01744 766 666
Fax: 01744 766 667
Email: technical.uk@knaufinsulation.com

Literature
Tel: 08700 668 660
Fax: 0870 400 5797
Email: info.uk@knaufinsulation.com

KNAUFINSULATION
it's time to save energy