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

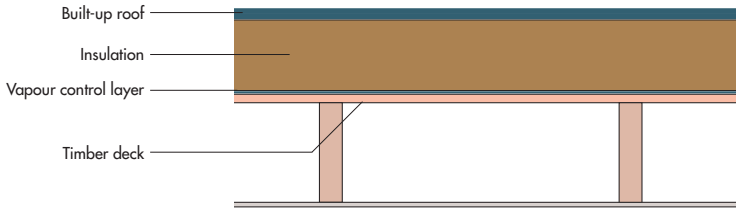
The roof structure must be capable of supporting all of the associated loadings. In addition, the wind pressure acting on the roof should be assessed in accordance with BS EN 1991-1-4:2005+A1:2010.

Drainage

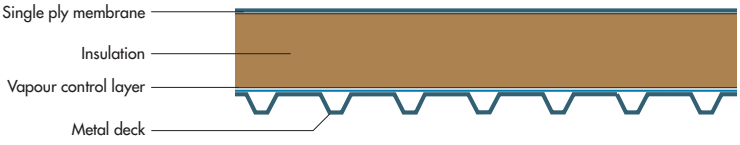
Guidance on the number and size of rainwater outlets can be obtained from BS EN 12056-Part 3: 2000. The drainage and edge details should be installed as per the waterproofing membrane manufacturer's instructions.

The three types of warm deck considered in this section

1. Warm deck – built-up roof



2. Warm deck – single ply membrane



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 1991-14:2005+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/m^2, 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 Support Team 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

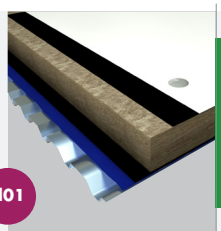
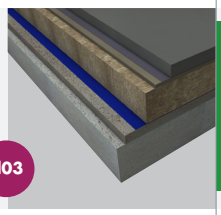
Flat roof design

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
Warm deck single ply membrane **Product:** Rocksilk Krimpact Flat Roof Slab See page: 96	 FI01																
Warm deck built-up felt/mastic asphalt **Product:** Rocksilk Krimpact Flat Roof Slab See page: 100	 FI03																
Cut-to-falls **Product:** Rocksilk Krimpact Cut-To-Falls system See page: 106	FI06																

Flat roofs

Warm deck single ply membrane

Rocksilk Krimpact Flat Roof Slab

Rocksilk Krimpact Flat Roof Slab

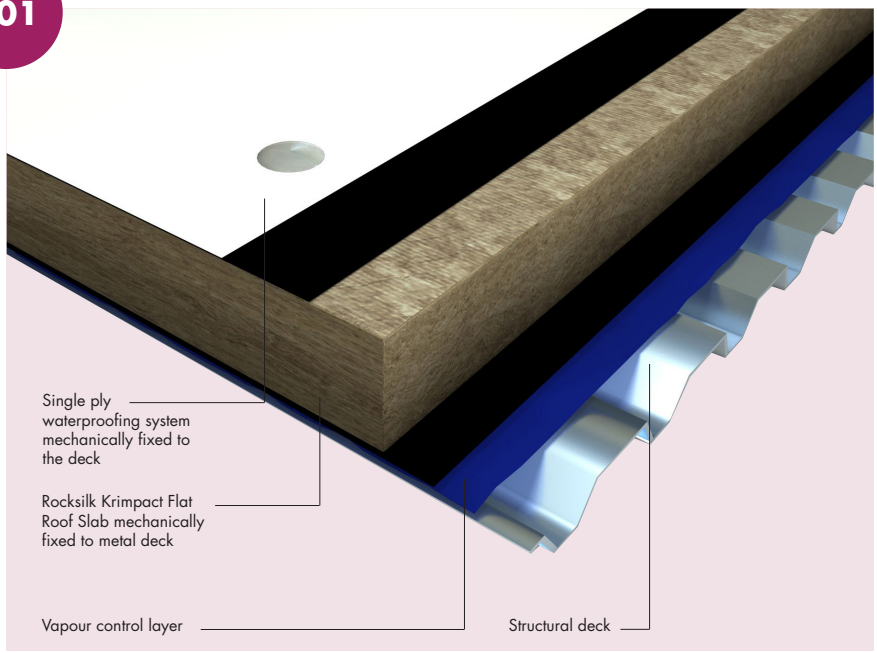
FI01

NEW BUILD REFURB

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

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

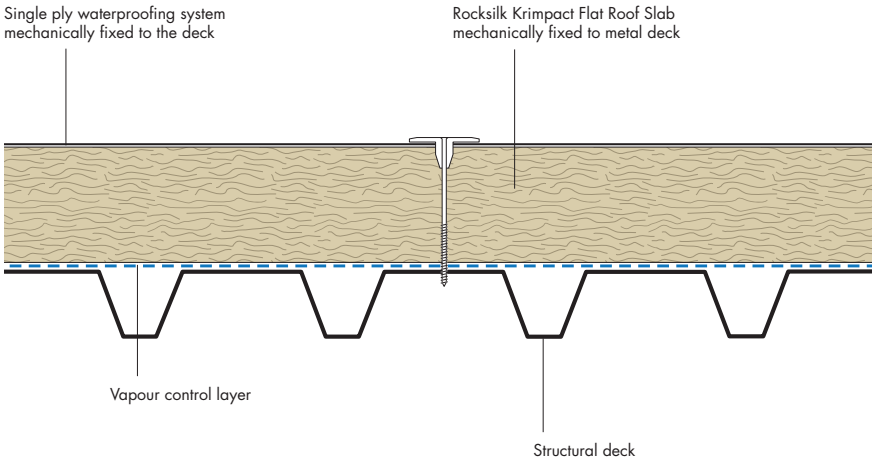
Thermal performance

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

Fire performance

Rocksilk Krimpact Flat Roof Slab is classified as A1 to BS EN 13501-1, the best fire performing insulation. Rocksilk Krimpact 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 Krimpact Flat Roof Slab, thickness .....mm 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

Typical U-values of warm deck single ply membrane roofs

Product	Thickness	U-values (W/m²K)		
	(mm)	150mm concrete 40mm screed 13mm plaster	Profiled metal deck	19mm chipboard timber joists 12.5mm plasterboard
Rocksilk Krimpact Flat Roof Slab	245 (145+100)	0.15	0.15	0.14
	200 (2x100)	0.17	0.19	0.17
	180	0.19	0.21	0.19

BBA CERTIFICATE CS/1001-2 U Value Competency Scheme

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

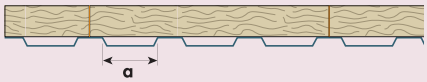
Flat roofs

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 Krimpact 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.

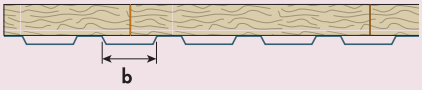
Maximum allowable span

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 built-up felt/mastic asphalt

Rocksilk Krimpact Flat Roof Slab

Rocksilk Krimpact Flat Roof Slab

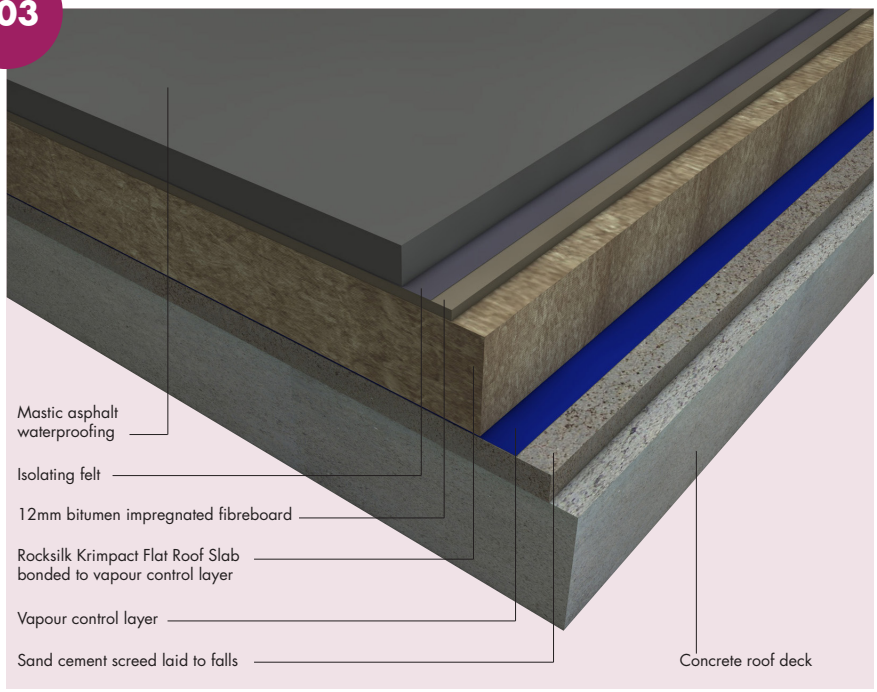
NEW BUILD REFURB

FI03

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

Rocksilk Krimpact 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 Krimpact 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 Krimpact 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 Krimpact Flat Roof Slab using traditional roll and pour methods. Rocksilk Krimpact Flat Roof Slab is not suitable for the direct application of torch-on roofing felts.

Mastic asphalt surface

Rocksilk Krimpact 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 Krimpact 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 Krimpact Flat Roof Slab is 0.038 W/mK.

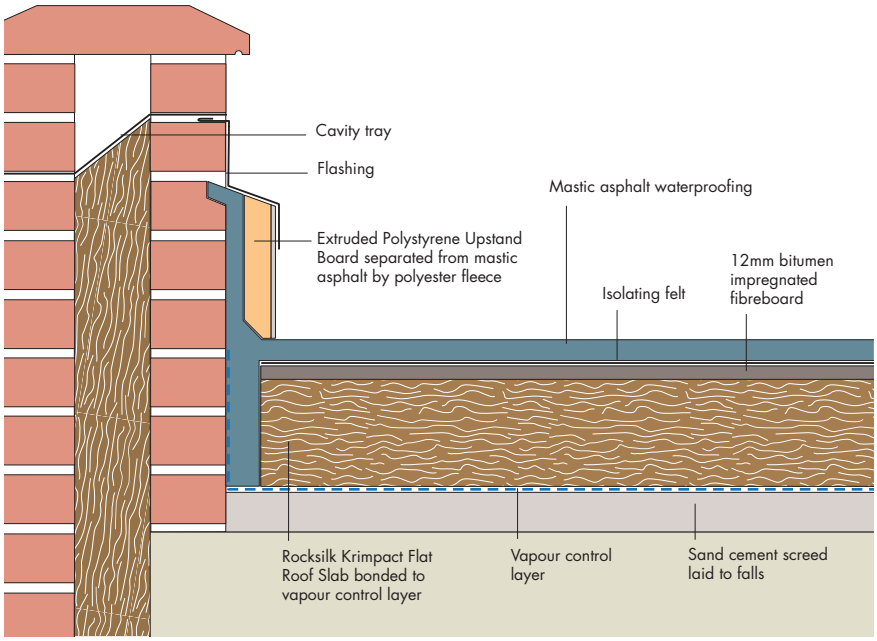
Compressive resistance

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

Fire performance

Rocksilk Krimpact 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 Krimpact 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

Typical U-values of flat roofs insulated with Rocksilk Krimpact Flat Roof Slab

Thickness	U-values (W/m^2K)		
(mm)	150mm concrete 40mm screed 13mm plaster	Profiled metal deck	19mm chipboard timber joists 12.5mm plasterboard
245 (145+100)	0.15	0.15	0.14
200 (2x100)	0.17	0.19	0.17
180	0.19	0.21	0.19

BBA CERTIFICATE CS/1001-2 U Value Competency Scheme

Note: For project specific calculations contact our Technical Support Team on 01744 766666.

Flat roofs

Cut-To-falls

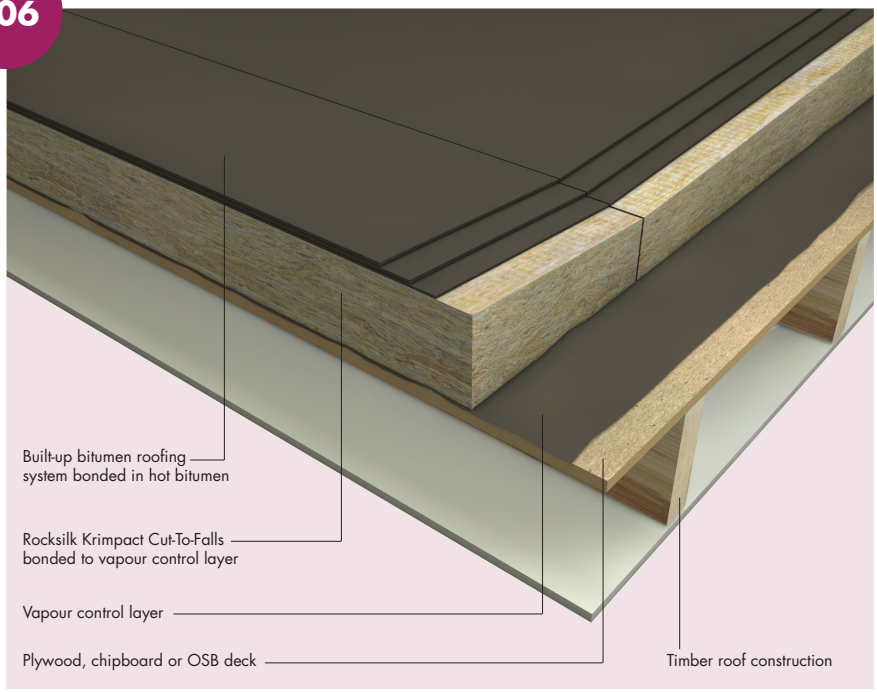
Rocksilk Krimpact Flat Roof Slab

FI06

- 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 Krimpact 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 Krimpact 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 Krimpact 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 Krimpact 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 Krimpact 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.

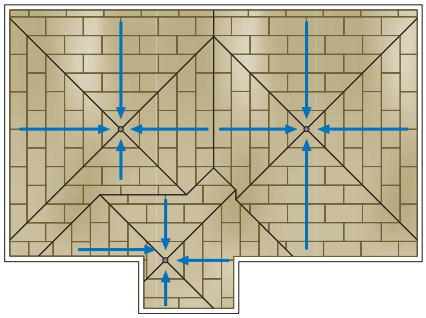
Mastic asphalt surface

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 Krimpact 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.

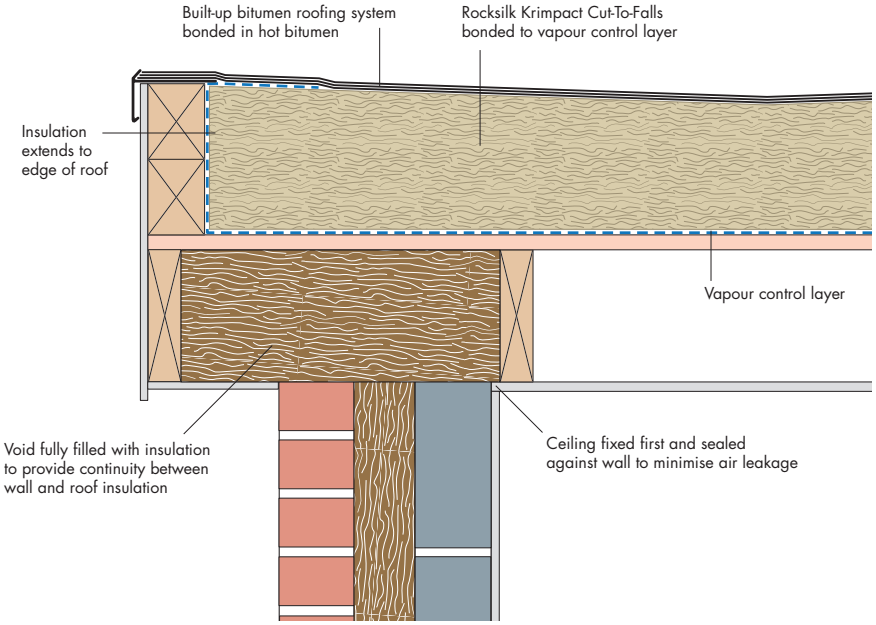
Compressive resistance

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

Thermal performance

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

Typical verge detail



Typical specification

The vapour control layer and Rocksilk Krimpact Cut-To-Falls .....mm thick to be fully bonded with hot bitumen. Rocksilk Krimpact 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

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

Typical U-values of cut to falls flat roofs

Product	Thickness	U-values (W/m²K)		
	(mm)	150mm concrete 40mm screed 13mm plaster	Profiled metal deck	19mm chipboard timber joists 12.5mm plasterboard
Rocksilk Krimpact 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 CS/1001-2 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 Krimpact Cut-to-Falls Slab.

For general technical enquiries on cut to falls roofing, contact the Knauf Insulation Technical Support Team on 01744 766666.

For a quotation on a specific project please contact Knauf Insulation Sales on 0844 800 0135.