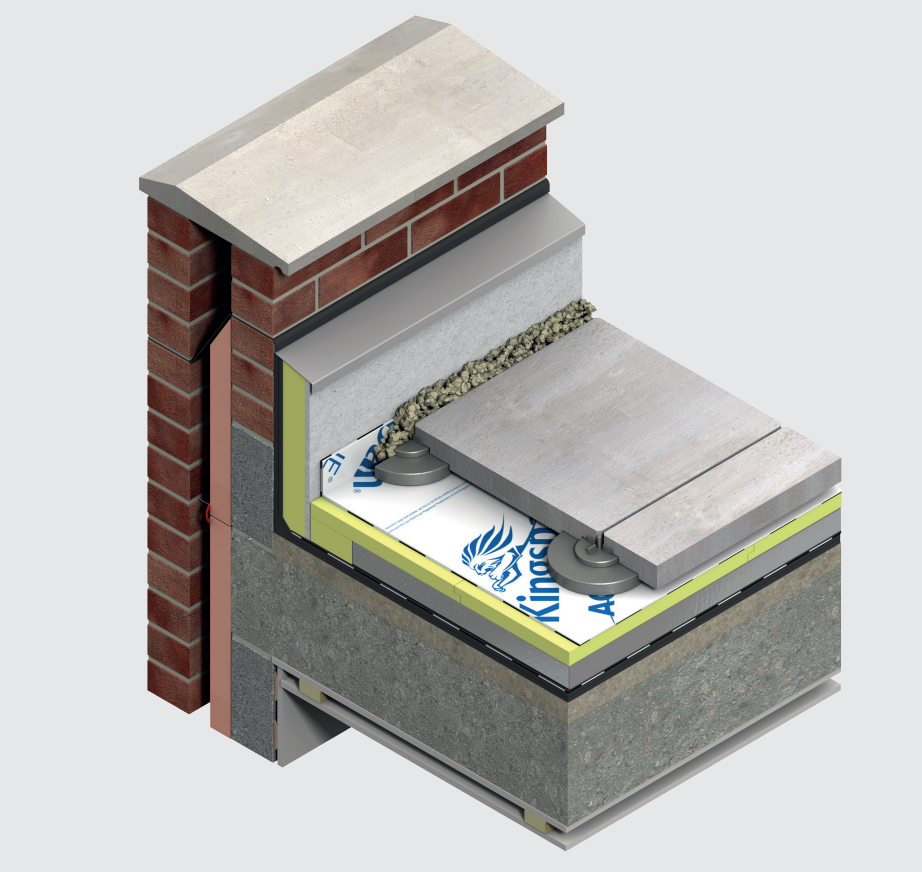
Third Issue | 09/2024

Kingspan OPTIM-R® E Inverted Roofing System

Encapsulated vacuum insulation panels for protected membrane flat roofs



- Optimum performance rigid vacuum insulation panel with a thermal conductivity as low as 0.008 W/mK, and a design thermal conductivity as low as 0.009 W/mK
- Ideal for constructions where a lack of construction depth or space is an issue
- Protective coating for increased robustness and easier handling
- Protects waterproofing membrane
- Compatible with green roof systems
- Resistant to the passage of water vapour
- Ideal for new build and refurbishment

Kingspan®

Introduction

The problem

When constructing a roof in new build situations or upgrading the thermal performance of roofs in existing buildings there may be a requirement for both low U-values and the thinnest possible roof build-up.

For new build applications, there are increasing regulatory requirements and economic reasons to improve energy efficiency. One of the more efficient approaches is to improve the thermal performance of the building fabric whilst keeping the overall construction as thin as possible. There are already high performance insulation products available that will fulfil some of these requirements, however in certain areas, for example where the design requirements are such, a new, thinner, product is needed.

In refurbishment there is arguably a greater need to keep roof build-ups as thin as possible. In certain applications internal space may be at a premium or there may be little space for installing new roof insulation, for example in buildings with planning height restrictions.

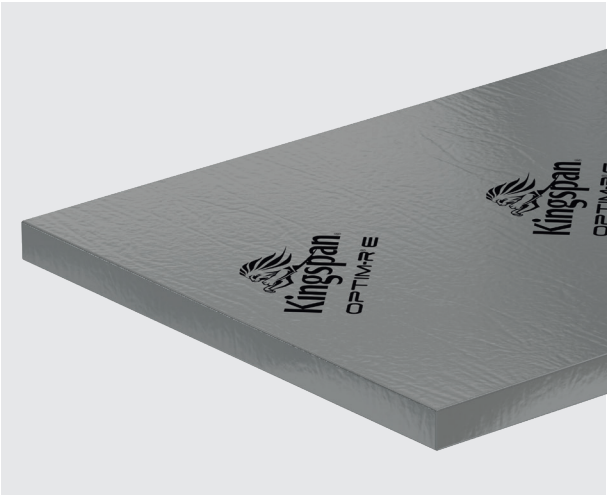
The solution

Kingspan OPTIM-R® E has been developed to help solve these problems. Kingspan OPTIM-R® E is an optimum performance solution from Kingspan Insulation. It comprises rigid vacuum insulation panels with a microporous core which is evacuated, encased and sealed in a thin, gas-tight envelope, giving outstanding thermal conductivity, with the thinnest possible solution to insulation problems.

Kingspan OPTIM-R® E is encapsulated in a coating for increased robustness and easier handling on-site. The vacuum insulation panels are accompanied by rigid extruded polystyrene insulation which can be cut to fit around penetrations such as outlets, roof lights or ventilator kerbs.

In retrofit applications, Kingspan OPTIM-R® E provides solutions for areas that previously could have remained un-insulated because of insufficient space available. In new constructions Kingspan OPTIM-R® E can significantly enhance U-values in areas that would otherwise be accepted as denigrating the overall thermal performance.

With a thermal conductivity as low as 0.008 W/mK, and a design thermal conductivity as low as 0.009 W/mK, Kingspan OPTIM-R® E provides an excellent solution for applications where a lack of construction depth or space is an issue.



Typical constructions

Assumptions

It is advised that the Kingspan Insulation Technical Service Department is contacted for specific U-value calculations (see rear cover for details).

All calculations are performed using the methods detailed in BS EN ISO 6946: 2017 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods) and using the conventions set out in BR 443 (Conventions for U-value calculations).

Concrete deck with paving slab ballast

Dense concrete deck with suspended ceiling

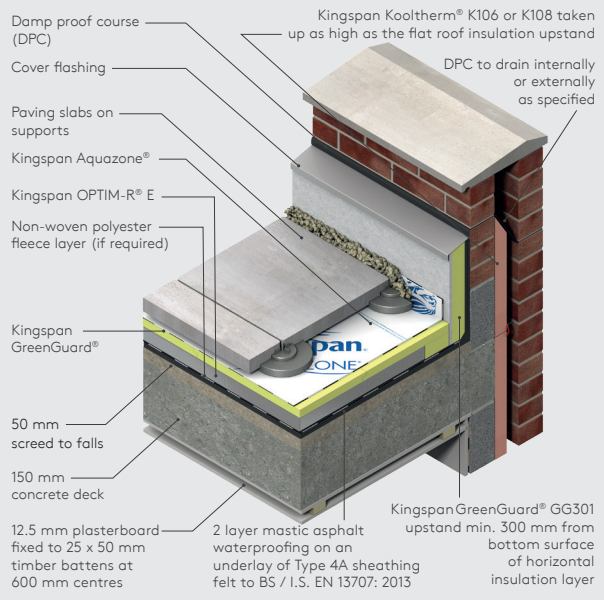


Figure 1

Concrete deck with gravel ballast

Dense concrete deck with suspended ceiling

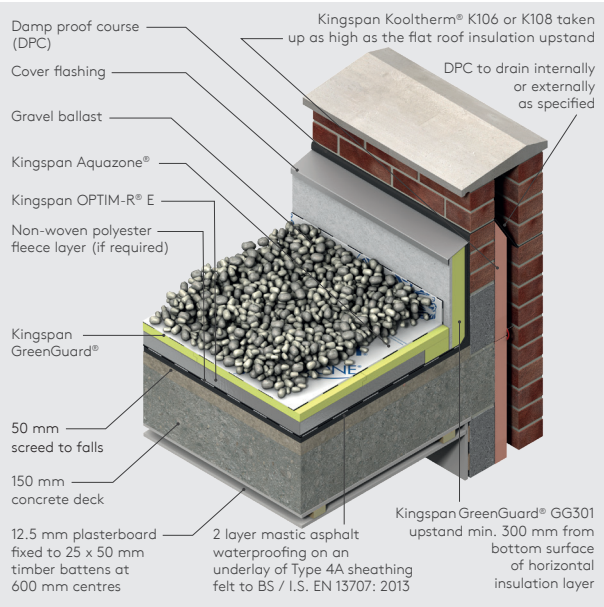


Figure 2

Typical constructions

Concrete deck with gravel ballast

Dense concrete deck with no ceiling

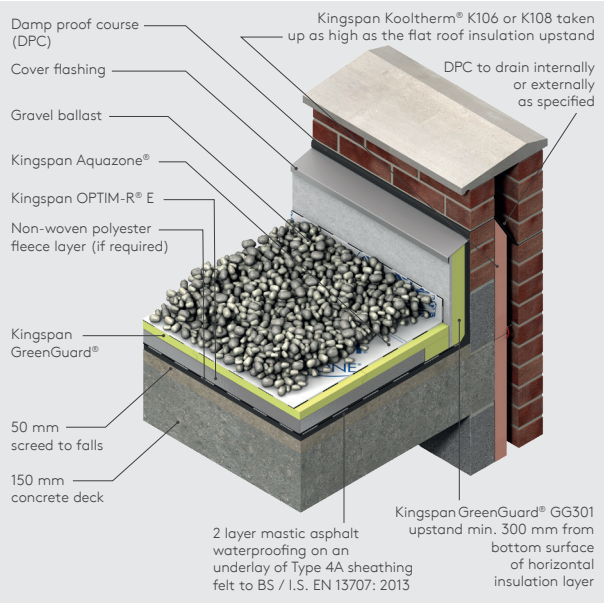


Figure 3

Green roofs

Intensive / semi-intensive green roof covering with no ceiling

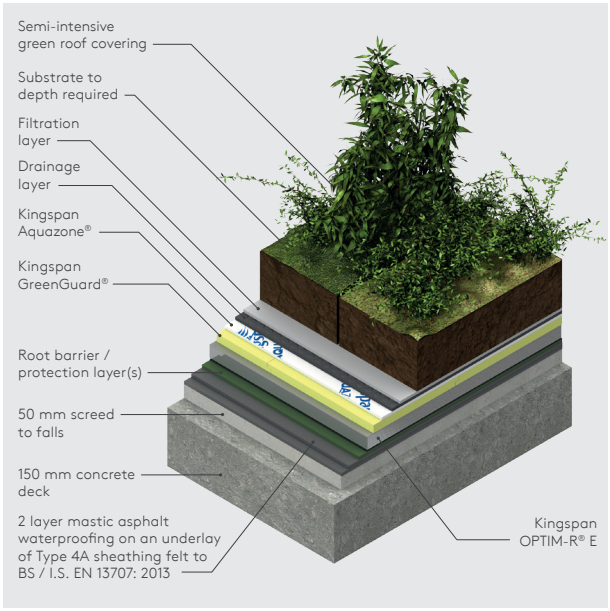


Figure 4

Design considerations

Linear thermal bridging

Basic principles

Linear thermal bridging describes the heat loss / gain that occurs at junctions between elements e.g. where an external wall meets the roof, or at junctions around openings in the building fabric where the thermal insulation layer is discontinuous e.g. sills, jambs and lintels.

Interruptions within the insulation layer by materials with poorer insulating properties can result in a thermal bridge, which in turn can lead to problems of condensation and mould growth, especially if there is a drop in surface temperature.

The heat flow at these junctions and opening locations, over and above that through the adjoining plane elements, is the linear thermal transmittance of the thermal bridge. This is measured in W/mK, referred to as a 'psi-value' and expressed as a 'ψ-value'.

The lower the ψ-value, the better the performance. ψ-values are taken into account in the calculation methodologies e.g. the Standard Assessment Procedure (SAP), that are used to assess the operational CO_2 emissions and, where applicable, the fabric energy efficiency of buildings.

ψ-values can comprise either, or a combination of, approved, calculated or assumed values.

Reducing linear thermal bridging

Detailing at junctions to minimise the effects of thermal bridging and the associated risk of condensation or mould growth is important and there are some simple design considerations that can be adopted to help mitigate the risks and to reduce heat losses.

- Care is required to ensure continuation of insulation wherever possible between the wall and roof for best thermal performance. Where this is not possible, the roof and wall insulation should be overlapped and ideally, insulation material introduced between.
- Parapet detailing can represent a good, low heat loss approach, with insulation continuity maintained using an insulated upstand to reduce cold bridging. A Kingspan GreenGuard® GG301 upstand should be used around the perimeter of the roof on the internal façade of parapets. The upstand should extend a minimum of 150 mm above the roof insulation and achieve a minimum distance of 300 mm between the top of the insulation upstand and the bottom of the horizontal roof insulation. Wall insulation should be carried up into parapets at least as high as the flat roof insulation upstand.
- For best thermal performance, roof-lights and ventilator kerbs should be insulated with the same thickness of Kingspan GreenGuard® GG301, with a separate backing layer of Kingspan GreenGuard®, as the general roof area (see Figure 6).
- Where a parapet construction is not used, to achieve best performance, the roof insulation should overlap the wall to extend the thermal bridge path, if necessary by adding thermal insulation to edge beams to achieve continuity with external insulation (see Figure 7).
- Insulate internal rainwater downpipes and other pipes that penetrate the roof if they pass through spaces with a high humidity and if any condensate will damage the structure or internal finishes. Use Kingspan GreenGuard® around the pipe outlet and with taping the external insulation prevent condensation from getting to the downpipes. A VCL internally is required to prevent this to restrict water vapour from reaching the pipe (see Figure 8).
- Where guttering is incorporated within a flat roof construction, this should be accounted for within the overall thermal design of the roof via an area-weighted calculation for the whole roof. The risk of localised interstitial condensation from reduced insulation provision at the gutter should be considered.
- Where an internal gutter is formed, vertical insulation should be used to reduce thermal bridging, using Kingspan GreenGuard® GG301 with a separate backing layer of Kingspan GreenGuard® (see Figure 9). A similar approach can also reduce losses where a change in levels is required (see Figure 11).
- Lightweight aggregate blockwork to the inner leaf of wall constructions can help to improve thermal performance at junctions generally and where used for the inner leaf of parapet walls it can help to reduce losses (see Figure 10).

Design service

The Kingspan OPTIM-R® E Inverted Roofing System comprises two elements: Kingspan OPTIM-R® E panels and Kingspan GreenGuard® rigid extruded polystyrene insulation infill panels. It comes with a supporting design service which ensures the ratio of the Kingspan OPTIM-R® E panels to infill panels for each project is maximised. The panel layout will be designed quickly and effectively, ready for client approval. Each layout will illustrate the size, number and location of the Kingspan OPTIM-R® E panels.

For more details please contact the Kingspan Insulation Technical Service Department (see rear cover).

Design considerations

Responsible sourcing

Kingspan OPTIM-R® E produced at Kingspan Insulation's Pembridge, Herefordshire manufacturing facility is manufactured under management system certified to ISO 14001: 2015 (Environmental management systems).

NB The above information is correct at the time of writing. Please confirm at the point of need by visiting the **Kingspan Insulation website** to download certificates.

Sustainability & responsibility

Kingspan Insulation has a long-term commitment to sustainability and responsibility: as a manufacturer and supplier of insulation products; as an employer; as a substantial landholder; and as a key member of its neighbouring communities.

A report covering the sustainability and responsibility of Kingspan Insulation Ltd's operations at its Pembridge, Herefordshire and Selby, North Yorkshire manufacturing facilities is available upon request from **literature@kingspaninsulation.co.uk**.

Specification clause

Kingspan OPTIM-R® E should be described in specifications as:–

The roof insulation shall be the Kingspan OPTIM-R® E Inverted Roofing System ___ mm thick: comprising a rigid vacuum insulation panel with a microporous core which is evacuated, encased and sealed in a thin, gas-tight envelope. The panel is encapsulated in a coating. The product shall be manufactured under a management system certified to ISO 9001: 2015, ISO 14001: 2015, ISO 37301: 2021, ISO 45001: 2018 and ISO 50001: 2018; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

Product classifications

Uniclass UK

Pr_25_57_06_94 Vacuum Insulated Panels

CAWS

J41/26 Thermal insulation
J41/430 Warm deck roof insulation
J42/120 Inverted roof covering
Q37/310 Inverted roof insulation

Details also available at **NBS Source**.

Design loads & roof structure

The suitability of the structure under consideration to accept design loads, including the increased dead load from ballast, snow and roof traffic, should be verified in accordance with BS EN 1991-1-3: 2003 + A1: 2015 (Eurocode 1. Actions on structures - General actions. Snow loads) / I.S. EN 1991-1-3: 2003 & AC: 2009 & A1: 2015 (Eurocode 1 - Actions on structures - Part 1-3: General actions - Snow loads).

The additional load from ballast can be considerable.

Ballast layer	Dead load
50 mm thick paving slabs	125 kg/m^2
Gravel (16-32 mm diameter)	16 kg/m^2 per 10 mm depth
Soil (intensive green roof)	180 - 500 kg/m^2
Soil (semi-intensive green roof)	120 - 200 kg/m^2
Soil (extensive green roof)	60 - 150 kg/m^2

The ballast layer resists wind uplift, prevents floatation of the boards after heavy rain, prevents UV degradation of the boards and gives the roof the required external fire performance.

Design considerations

Wind loads

The resistance of the waterproofing system, insulation and ballast to wind uplift should be assessed in accordance with BS EN 1991-1-4: 2005 + A1: 2010 (Eurocode 1. Actions on structures - General actions - Wind Actions) / I.S. EN 1991-1-4: 2005 (Eurocode 1: Actions on structures - Part-1-4: General actions - Wind actions). BRE Digest 295 gives specific design guidelines for loose-laid insulation systems.

For constructions located in sheltered exposure zones, or on buildings of up to 10 storeys, the self weight of a minimum 50 mm gravel ballast layer (minimum 80 kg/m^2), installed over a non-woven polyethylene membrane, is generally sufficient to ensure that both the insulation boards and waterproofing system remain stable under the full design load.

For constructions located in moderate exposure zones, or on buildings of up to 10 to 15 storeys, this gravel ballast specification is generally sufficient, but the perimeter should be loaded with 50 mm thick paving slabs.

For severe exposure zones or tall buildings over 15 storeys, specialist advice should be sought. BRE Digest 311 (Wind scour of gravel ballast on roofs) should be used when a calculation is required for a specific building project.

Floatation

The ballast specifications detailed in the 'Wind Loads' section (above) will be sufficient to prevent floatation of the insulation boards after heavy rain.

Falls

The fall on a flat roof, constructed using Kingspan OPTIM-R® E is normally provided by the supporting structure being directed towards the rainwater outlets. The fall should be smooth and steep enough to prevent the formation of rainwater ponds. In order to ensure adequate drainage, BS 6229: 2018 (Flat roofs with continuously supported flexible waterproof coverings. Code of practice) recommends uniform gradients of not less than 1 in 80. However, because of building settlement, it is advisable to design in even greater falls.

Protected membrane roofing systems incorporating Kingspan OPTIM-R® E can be laid on roofs with a finished fall of less than 1:80, but the waterproofing system must be of a tanking specification.

Design details

Paving slab ballasted protected membrane roof details

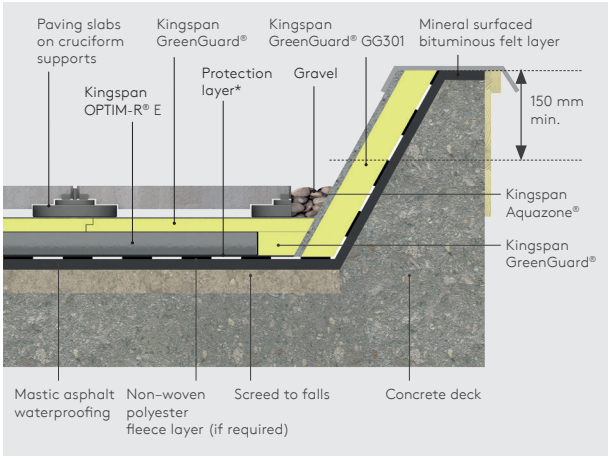


Figure 6 - Eave / kerb detail

* Refer to Sitework

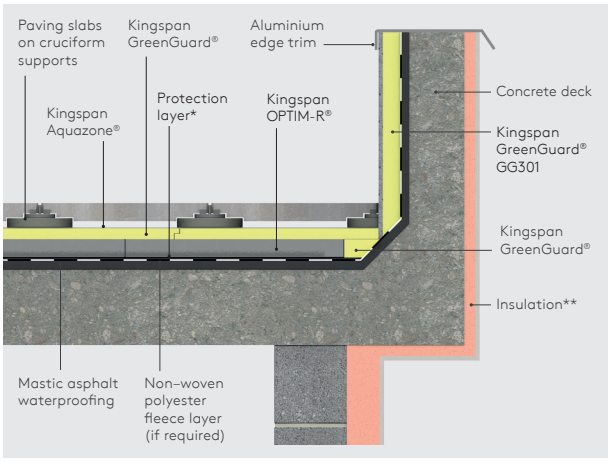


Figure 7 - Eave / gutter detail

* Refer to Sitework

** The insulation specification will depend on the full build up and facade finish

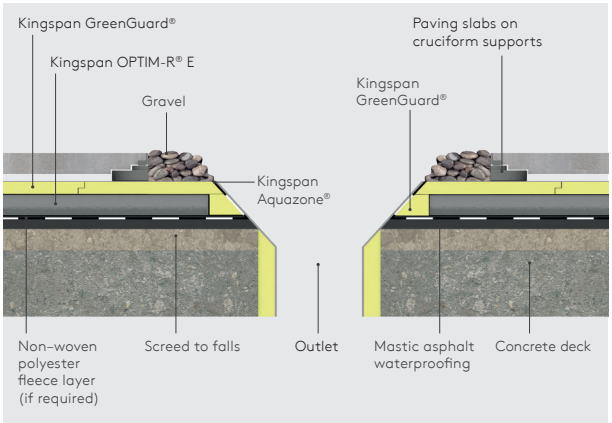


Figure 8 - Two level drainage

Design considerations

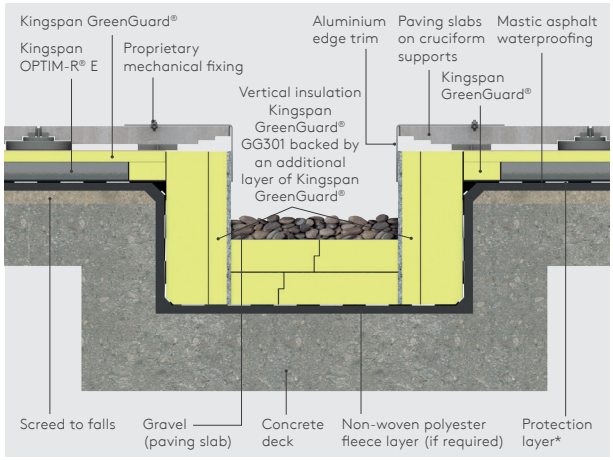


Figure 9 - Internal gutter

* Refer to Sitework

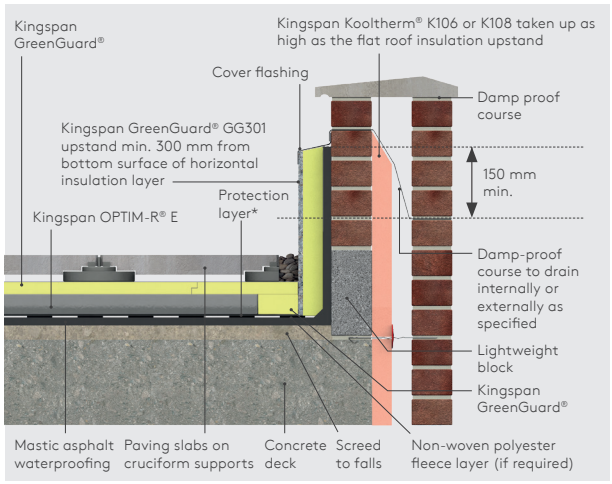


Figure 10 - Parapet abutment

* Refer to Sitework

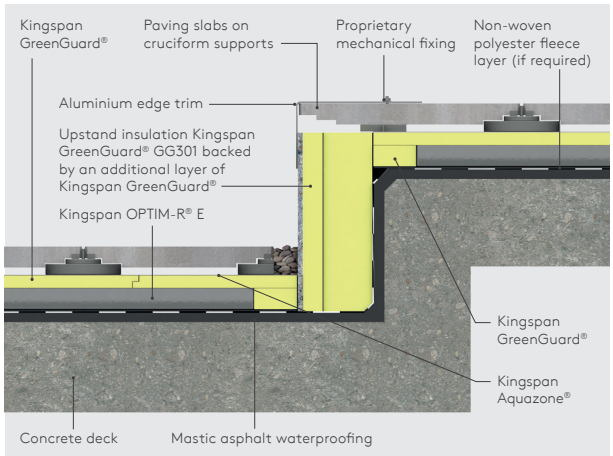


Figure 11 - Change in level

Rainfall factors

The requirements of BS EN ISO 6946: 2017 / I.S. EN ISO 6946: 2017 part D.4.2. (Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods) dictate that inverted roof constructions are subject to a geographical rainfall analysis. The cooling effect of rainwater flowing between and beneath the insulation boards, can mean that greater thicknesses of insulation are required to meet desired U-values, particularly in locations that receive high levels of rainfall.

The use of a high performance non-woven polyethylene membrane, such as Kingspan Aquazone®, over the insulation (see figs 6-11), can dramatically minimize heat loss by reducing the amount of rainwater that flows between and beneath the insulation boards.

This reduction in rainwater flow is represented by the infiltration (fx) factor of the membrane. The fx factor of a membrane is fall (gradient) specific, and an fx factor measured on a fall can not be used to represent the performance of a membrane if installed horizontally.

Drainage

The number and type of rainwater outlets should be assessed in accordance with BS EN 12056-3: 2000 (Gravity drainage systems inside buildings - Roof drainage, layout and calculation) / I.S. EN 12056-3: 2000 (Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation). The rainwater outlets should be double entry type, to allow rainwater to be drained from the roof surface at both the membrane level and the upper surface level. When using paving slabs as ballast, on a roof with a finished fall of less than 1:80, they must be laid on supports, in order to aid drainage.

The drainage of green roofs should be carefully considered, especially in the case of intensive systems, which may require a moisture retention layer to ensure adequate moisture levels for the system but still allow the rapid drainage of excess rainwater. Dam type rainwater outlets that hold water in the system are not recommended, as the depth of water may create a moisture vapour impermeable layer above the insulation.

Sitework

Roof waterproofing

Kingspan OPTIM-R® E is suitable for use over most fully adhered single-ply waterproofing membranes.

Kingspan OPTIM-R® E is also suitable for use over mastic asphalt waterproofing systems. Mastic asphalt waterproofing should be laid, where applicable, in accordance with BS 8218: 1998 (Code of practice for mastic asphalt roofing). Mastic asphalt should always be laid over an isolating layer of loose-laid Type 4A sheathing felt to BS / I.S. EN 13707: 2013 (Flexible sheets for waterproofing. Reinforced bitumen sheets for roof waterproofing. Definitions and characteristics).

Kingspan OPTIM-R® E is also suitable for use over most fully cured hot and cold liquid applied waterproofing systems.

Mastic asphalt, some single-ply and some hot liquid applied waterproofing systems require a separation layer (non-woven polyester fleece layer, 130–140 g/m^2, with an overlap of 250 - 300 mm) positioned between the membrane and the insulation.

Waterproofing systems containing solvents should be allowed to fully cure before installing Kingspan OPTIM-R® E.

Water vapour control

Protected membrane roofs are inherently safe in respect of condensation risk. The roof design can be assessed for the risk of interstitial condensation using BS 5250: 2021 (Management of moisture in buildings. Code of practice) or BS 6229: 2018.

Green roofs

Kingspan OPTIM-R® E is suitable for use under most green roof systems.

Green roof systems are a specialist design area. When designing a loose-laid insulated green roof assembly consideration needs to be given to the following.

Green roof systems are required to have a minimum dry weight of 80 kg/m^2 to ballast the insulation boards beneath them. However, the total required dry weight will depend upon wind uplift, which in turn will vary with the geographical location of the building, local topography, and the height and width of the roof concerned. The necessity for any additional dry weight should be assessed in accordance with BS EN 1991-1-4: 2005 + A1: 2010 / I.S. EN 1991-1-4: 2005.

When installing a loose-laid insulated green roof assembly, any insulation must be immediately over-laid with the green roof system, which must meet all of the requirements outlined above.

For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).

Sitework

Waterproofing

- Prior to installing Kingspan OPTIM-R® E, it is essential to ensure that the waterproofing system has been installed correctly and that the roof is watertight and clean. The surface of the waterproofing should be smooth, flat and free from projections.
- Single-ply membranes, in particular, need careful attention to ensure that there has been no damage from following trades, and that puncturing from below the membrane (from nail heads or debris) cannot occur.
- If a single-ply membrane or mastic asphalt waterproofing system has been installed, a non-woven polyester fleece separation layer, with 250 - 300 mm overlaps, should be laid on top of the membrane prior to the installation of the insulation.

Insulation panels

- An optional protection layer may be used under the Kingspan OPTIM-R® E panels. For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).
- Kingspan OPTIM-R® E panels should be laid break bonded where practical, with joints lightly butted. There should be no gaps at abutments. All Kingspan OPTIM-R® E panels are to be installed with the film flaps against the substrate.
- Where runs of Kingspan OPTIM-R® E panels do not accurately fit the dimension of the roof, the use of Kingspan GreenGuard® strips is required to make up this difference. Each Kingspan GreenGuard® strip is to be the same thickness as the OPTIM-R® E panels.
- A Kingspan GreenGuard® overlay should be laid as soon as possible to avoid exposure of the Kingspan OPTIM-R® E to direct foot traffic.
- Roof-light or ventilator kerbs, gutters etc. should always be insulated (Kingspan GreenGuard® GG301 with a separate backing layer of Kingspan GreenGuard®) to the same U-value as the general roof area.
- At the perimeter of the roof and where upstands or any penetrations (e.g. drainage outlets) are present, Kingspan GreenGuard® strips should be laid abutting these areas, to take account of building tolerances. For some roof designs, Kingspan OPTIM-R® E could be laid on the abutment. This will be detailed in the design for the individual project.
- A Kingspan GreenGuard® GG301 upstand should be used around the perimeter of the roof on the internal façade of parapets.
- A minimum distance of 300 mm should be maintained between the top of the insulation upstand and the bottom of the horizontal roof insulation.
- Kingspan OPTIM-R® E can be laid in any weather but care must be taken in windy conditions.

Kingspan Aquazone®

- Kingspan Aquazone® should be laid over the insulation panels.
- Where one run of the membrane laps another, there should be a minimum 300 mm side and end overlaps.
- The membrane should be terminated flush with the paving slabs and / or ballast.

Gravel ballast

- Install the ballast layer as soon as possible, to ensure that the Kingspan Aquazone® is always protected and excessive heat build up or high winds do not damage the insulation panels.
- Gravel ballast should be washed, rounded, nominal 20-40 mm diameter, and of minimum depth 50 mm.
- The diameter of the gravel is important as this size has been found to be the most resistant to wind scour, BRE Digest 311 gives advice.

Paving slab ballast

- Min. 50 mm thick paving slabs should be laid, over the Kingspan Aquazone®, on proprietary paving slab supports of minimum 175 mm (or equivalent base area), in order to maintain drainage below the slabs, and to ensure that moisture vapour can escape.
- Install paving slabs and supports as soon as possible, to ensure that the Kingspan Aquazone® is always protected and excessive heat build up or high winds do not damage the insulation panels
- Gaps between the paving slabs and upstands should be filled with washed, rounded gravel, nominal 20 - 40 mm diameter.

Roof gardens

- Having chosen the type of planting system and correctly detailed the various filter layers, moisture retention layers and growing medium, the installation, especially of extensive systems, is quick and simple.
- A root barrier (unless provided by the waterproofing layer) should be loose-laid on or bonded to the waterproofing membrane with all the laps sealed.
- The root barrier should be turned up at the edge of the roof insulation and sealed under the flashing.
- The Kingspan OPTIM-R® E panels should be installed as described previously.
- Panels should be overlaid with Kingspan Aquazone®, which should be installed as described previously.
- A filtration layer or combined filtration layer / drainage mat is then installed, per its manufacturer's instructions.

Sitework

- The growing medium, generally 50 - 200 mm deep is then installed. Specialist spray systems are available, which allow the application of the growing medium and grass / plant seed to be applied in one operation.
- The depth of growing medium should be assessed for wind loads in accordance with BS EN 1991-1-4: 2005 + A1: 2010 / I.S. EN 1991-1-4: 2005. BRE Digest 295 gives specific design guidelines for loose-laid insulation systems.

Wheeled / foot traffic

- Kingspan OPTIM-R® E panels should not be walked on. A protective foot or crawl board should be used during the installation process.
- The Kingspan GreenGuard® strips and overlay may be walked on.

General

- Kingspan OPTIM-R® E should not be used in association with solvent-based adhesive systems. Kingspan OPTIM-R® E should not be exposed to naked flames or excessive heat.

Cutting

- The Kingspan OPTIM-R® E panels should not be cut or penetrated. The substrate must be clean, dry and level, and free of sharp objects or edges.
- Cutting of Kingspan GreenGuard® strips should be carried out either by using a fine toothed saw, or by scoring with a sharp knife, snapping the board over a straight edge and then cutting the facing on the other side.
- Ensure accurate trimming of Kingspan GreenGuard® strips to achieve close-butting joints and continuity of insulation.

Availability

- Please contact Kingspan Insulation for availability of the Kingspan OPTIM-R® E Inverted Roofing System.

Packaging and storage

- The packaging of the Kingspan OPTIM-R® E Inverted Roofing System should not be considered adequate for outdoor protection. The Kingspan OPTIM-R® E Inverted Roofing System should be stored inside a building and raised off the floor.

UV exposure

- It is recommended that Kingspan OPTIM-R® E is not exposed to direct sunlight for a period of time exceeding four weeks.

Health and Safety

- Kingspan Insulation products are chemically inert and safe to use.
- A Safety Information Data Sheet for this product is available from the Kingspan Insulation website **www.kingspaninsulation.co.uk/safety** or **www.kingspaninsulation.ie/safety**.

Warning - do not stand on or otherwise support your weight on this product unless it is fully supported by a load bearing surface.

Product details

Composition

Kingspan OPTIM-R® E panels comprise a rigid vacuum insulation panel with a microporous core which is evacuated, encased and sealed in a thin, gas-tight envelope. Kingspan OPTIM-R® E panels are encapsulated in a protective coating for increased robustness and easier handling on-site.

Kingspan GreenGuard® comprises a high performance rigid extruded polystyrene insulation.

Standards and approvals

Kingspan OPTIM-R® is manufactured to the highest standards under a management system certified to ISO 9001: 2015 (Quality management systems), ISO 14001: 2015 (Environmental management systems), ISO 37301: 2021 (Compliance management systems), ISO 45001: 2018 (Occupational health and safety management systems) and ISO 50001: 2018 (Energy management systems).

Standard dimensions

Kingspan OPTIM-R® panels are available in the following standard size(s):

Nominal dimension		Availability
Length x width*	(mm)	600 x 400 600 x 600 1200 x 300 1200 x 400 1200 x 600
Insulant thickness*	(mm)	20 - 50

* Excludes spray coating thickness.

Compressive strength

The average compressive strength of Kingspan OPTIM-R® E panels exceeds 150 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building application. Determination of compression behaviour).

Durability

If installed correctly and protected from damage and penetration, the Kingspan OPTIM-R® E Inverted Roofing System can provide reliable long-term thermal performance over the lifetime of the building.

Resistance to solvents, fungi & rodents

The Kingspan OPTIM-R® E Inverted Roofing System should not be used in association with solvent-based adhesive systems. Damaged boards or boards that have been in contact with solvents or acids should not be used.

The insulation core and facings used in the manufacture of the Kingspan OPTIM-R® E Inverted Roofing System resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire performance

For guidance regarding the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at **www.kingspaninsulation.co.uk/fireregulations** (for GB) or contact technical services at **technical@kingspaninsulation.ie** (for Ireland).

Kingspan OPTIM-R® E fire performance

Kingspan OPTIM-R® E achieves European Classification (Euroclass) E when classified to BS EN 13501-1: 2018 (Fire classification of construction products and building elements - classification using data from reaction to fire tests) / I.S. EN 13501-1: 2018 (Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests). Please see the table below for further test information, conditions and field of application. To request a copy of the test report please contact the Kingspan Insulation Technical Service Department (see rear cover).

Test report number	EUI-22-SFB-000012
Classification report number	EUI-22-000012-REVISION-1
Asymmetry	Valid for fire on both sides

Kingspan GreenGuard® GG300 fire performance

Under System 4 AVCP, Kingspan GreenGuard® GG300 has a Euroclass rating of F.

Roof covering products (and/or materials) defined in Commission Decision 2000/553/ EC of 6 September 2000, implementing Council Directive 89/106/EEC, can be considered to fulfil all of the requirements for the performance characteristic 'external fire performance' without the need for testing, provided that any national provisions on the design and execution of works are fulfilled, and can be used without restriction. This applies to products intended to be fully covered in normal usage by the inorganic coverings listed below:

- loose laid gravel with a thickness of at least 50 mm or a mass ≥ 80 kg/m^2 (minimum aggregate size 4 mm, maximum 32 mm)
- sand/cement screed to a thickness of at least 30 mm
- cast stone or mineral slabs of at least 40 mm thickness.

For other configurations of coverings, please contact the system supplier.

Further details on the fire performance of Kingspan Insulation products may be obtained from the Kingspan Insulation Technical Service Department (see rear cover).

Product details

Thermal performance

The λ-values and R-values detailed below are quoted in accordance with BS EN 12667: 2001 (Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance), with allowance for ageing and edge effect of the encapsulating film to form the design value.

Thermal conductivity

Kingspan OPTIM-R® E panels achieve a thermal conductivity (λu-value) of 0.008 W/mK for panel sizes:

- 600 x 400 mm
- 600 x 600 mm
- 1200 x 400 mm
- 1200 x 600 mm.

Kingspan OPTIM-R® E panels achieve a thermal conductivity of 0.009 W/mK for panel size:

- 1200 x 300 mm.

Thermal resistance

Thermal resistance (R-value) varies with thickness and is calculated by dividing the thickness of the panel (expressed in metres) by its thermal conductivity. The resulting number is rounded down to the nearest 0.05 (m^2K/W).

Insulant thickness (mm)	Thermal resistance (m^2K/W)	
	Panel sizes (mm): 600 x 400, 600 x 600, 1200 x 400 and 1200 x 600	Panel size (mm): 1200 x 300
20	2.50	2.20
25	3.10	2.75
30	3.75	3.30
40	5.00	4.40
50	6.25	5.55

Design thermal conductivity

In applications where Kingspan OPTIM-R® E could come into contact with moisture, a design thermal conductivity is taken into account within U-value calculations.

Kingspan OPTIM-R® E panels achieve a design thermal conductivity (λu-value) of 0.009 W/mK for panel sizes:

- 600 x 400 mm
- 600 x 600 mm
- 1200 x 400 mm
- 1200 x 600 mm.

Kingspan OPTIM-R® E panels achieve a design thermal conductivity of 0.010 W/mK for panel size:

- 1200 x 300 mm.

Contact details

Great Britain

Kingspan Insulation Ltd
Pembridge | Leominster
Herefordshire | HR6 9LA

T: +44 (0) 1544 388 601
E: info@kingspaninsulation.co.uk
www.kingspaninsulation.co.uk

For individual department contact details please visit
www.kingspaninsulation.co.uk/contact

Ireland

Kingspan Insulation Ltd
Castleblayney | County Monaghan

T: +353 (0) 42 979 5000
E: info@kingspaninsulation.ie
www.kingspaninsulation.ie

For individual department contact details please visit
www.kingspaninsulation.ie/contact

For the most up-to-date version of this brochure please scan or click here.

To access pre-existing product information or information relating to previously sold/discontinued products please email literature@kingspaninsulation.co.uk.