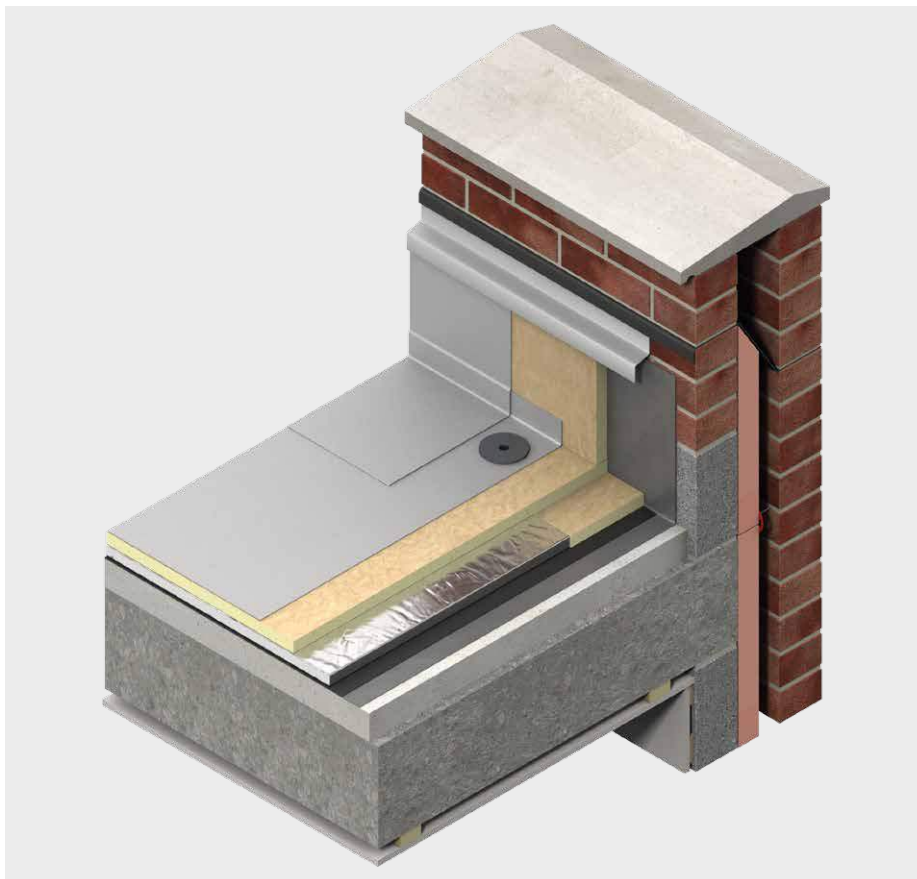


# OPTIM-R® Roofing System

Next generation insulation solution for flat roofs and roof terraces



- Optimum performance rigid vacuum insulation panel with a declared thermal conductivity of 0.007 W/mK
- Certified by BDA Agrément®\*
- Resistant to the passage of water vapour
- Ideal for new build and refurbishment
- Non-deleterious material

\*Certified for thicknesses of 20 - 50 mm

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# Introduction

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## The problem

When constructing a roof or a roof terrace in new-build situations or replacing a roof or roof terrace 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 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 the majority of these requirements, however in certain areas, for example where the design demands it, 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.



Figure 1: Kingspan OPTIM-R<sup>®</sup> vacuum insulation panel

## The solution

Kingspan OPTIM-R<sup>®</sup> has been developed to help solve these problems. OPTIM-R<sup>®</sup> is an optimum performance next generation insulation solution from Kingspan Insulation. It comprises of rigid vacuum insulation panels with a micro-porous core which are evacuated, encased and sealed in a thin, gas-tight envelope, giving outstanding thermal conductivity, with the thinnest possible solution to insulation problems. The vacuum insulation panels are accompanied with rigid thermoset polyisocyanurate (PIR) insulation infill panels which can be cut to fit around problem areas such as roof lights, ventilator kerbs or drainage gutters.

In retrofit applications, Kingspan OPTIM-R<sup>®</sup> provides solutions for areas that previously would have remained un-insulated because of insufficient space available.

In new constructions, Kingspan OPTIM-R<sup>®</sup> can significantly enhance U-values in areas that would otherwise be accepted as denigrating the overall thermal performance.

The high level of thermal efficiency with minimal thickness achieved by the Kingspan OPTIM-R<sup>®</sup> Roofing System provides solutions for applications where a lack of construction depth or space is an issue.

# Design service

The Kingspan OPTIM-R® Roofing System comprises 2 elements: Kingspan OPTIM-R® panels and Kingspan OPTIM-R® flex infill strips. It comes with a supporting design service which ensures the ratio of OPTIM-R® panels to OPTIM-R® flex 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 OPTIM-R® panels. It will also illustrate the size, number and location of any OPTIM-R® flex infill strips required.

Examples of a typical design layout can be seen in Figure 2.

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

Included in the design service is the calculation of condensation risk in accordance with BS 5250: 2021 (Management of moisture in buildings. Code of practice). This ensures that any predicted dew point is above the vapour control layer at the point of minimum thickness of the Kingspan OPTIM-R®, whilst also ensuring any condensation risk is within the limits given in BS 5250: 2021.

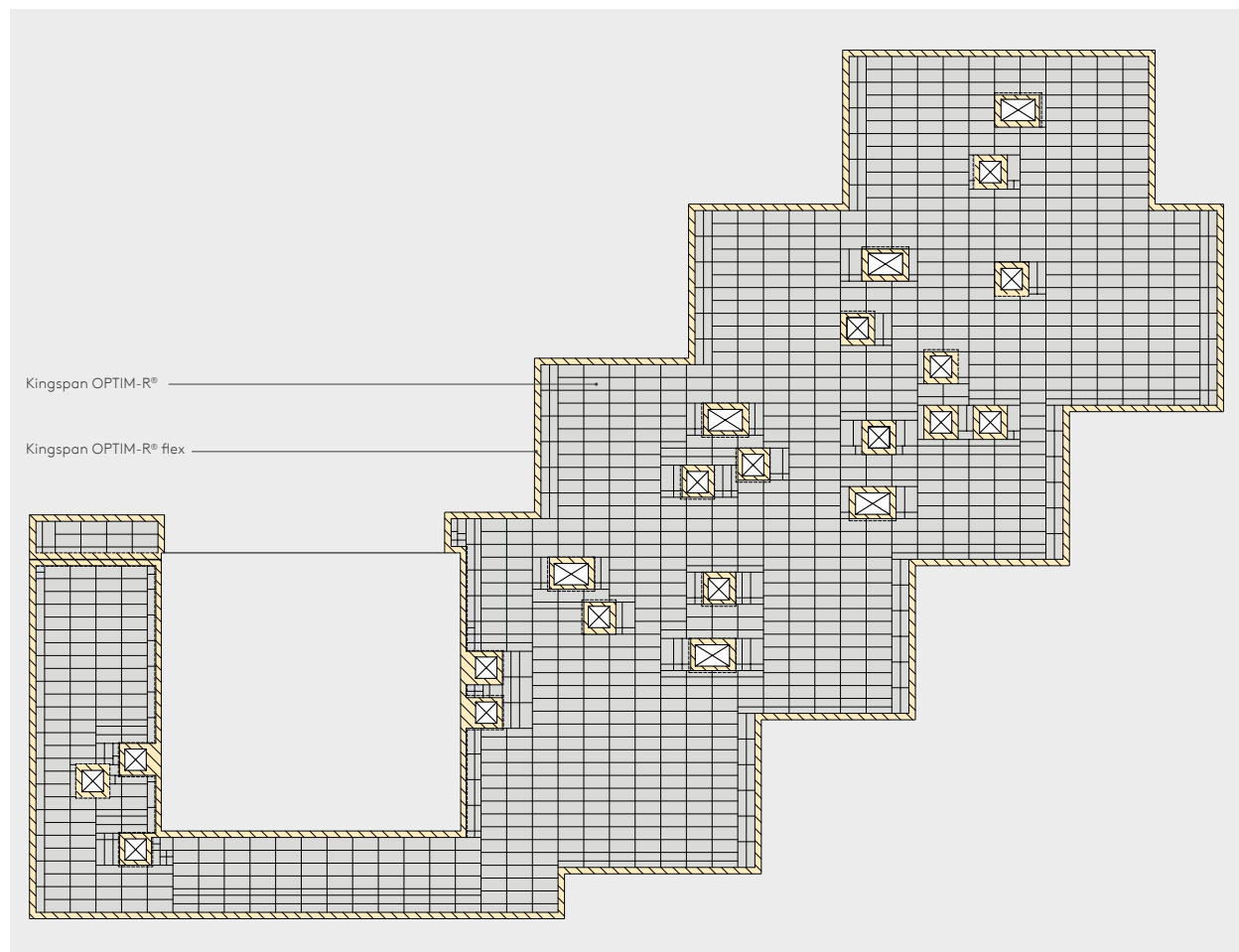


Figure 2

# Typical constructions and U-values

## Assumptions

The U-values in the tables that follow have been calculated, using the method detailed in BS EN ISO 6946: 2017 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method) and using the conventions set out in BR 443 (Conventions for U-value calculations). They are valid for the constructions shown in the details adjacent to each table.

N.B. For the purposes of these calculations the standard of workmanship has been assumed good and therefore the correction factor for air gaps has been ignored.

N.B. The figures quoted are for guidance only. A detailed U-value calculation together with condensation risk analysis should be completed for each individual project.

N.B. To gain a comprehensive U-value calculation for your project please consult the Kingspan Insulation Technical Service Department for assistance (see rear cover).

## Concrete deck

### Dense concrete deck with suspended ceiling

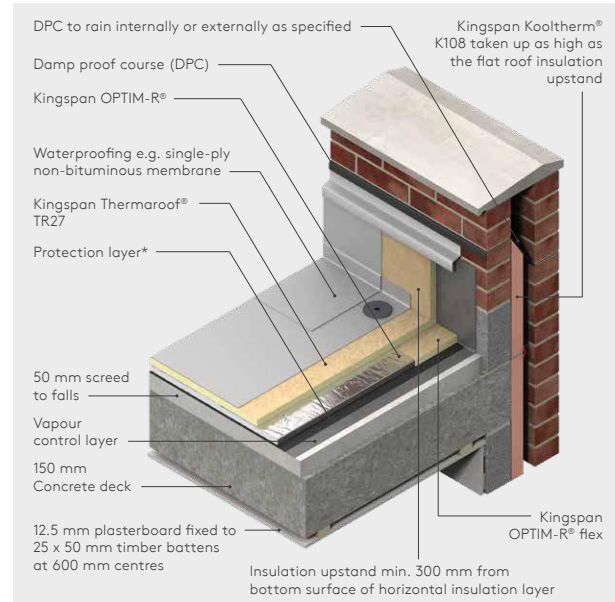


Figure 3

Kingspan OPTIM-R® thickness (mm)	Kingspan ThermoRoof® TR27 overlay thickness (mm)	U-values (W/m <sup>2</sup> K)
40	30	0.18
50	25	0.16
50	30	0.15
30 + 30	25	0.14
30 + 30	30	0.13
40 + 30	25	0.12
40 + 40	25	0.11
50 + 40	25	0.10
50 + 50	25	0.09

\* Refer to sitework.

NB For the purposes of these calculations, the bridging effect Kingspan OPTIM-R® flex has been taken to be 11%. This figure is a starting point; for accurate calculations a design will be required and the bridging effect may change the U-values achieved.

# Typical constructions and U-values

Dense concrete deck with suspended ceiling and Kingspan GreenGuard® overlay (heavy traffic areas)

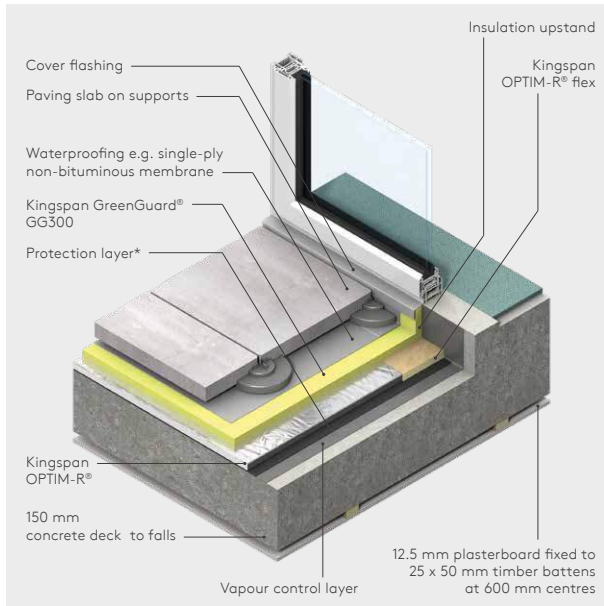


Figure 4

Kingspan OPTIM-R® thickness (mm)	Kingspan GreenGuard® GG300 overlay thickness (mm)	U-values (W/m²K)
20	30	0.28
25	30	0.25
30	30	0.22
40	30	0.18
50	30	0.16
30 + 30	30	0.14
40 + 30	30	0.12
40 + 40	30	0.11
40 + 50	30	0.10
50 + 50	30	0.09

\* Refer to sitework.

NB For the purposes of these calculations, the bridging effect Kingspan OPTIM-R® flex has been taken to be 20%. This figure is a starting point; for accurate calculations a design will be required and the bridging effect may change the U-values achieved.

## Timber deck

Timber deck with plasterboard ceiling and Kingspan Therमारoo® TR27 overlay

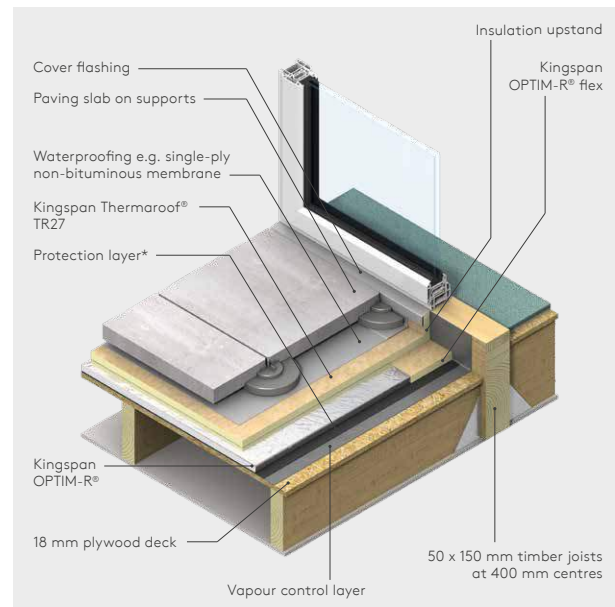


Figure 5

Kingspan OPTIM-R® thickness (mm)	Kingspan Therमारoo® TR27 overlay thickness (mm)	U-values (W/m²K)
20	25	0.28
25	25	0.25
30	25	0.22
40	25	0.18
50	25	0.16
30 + 30	25	0.14
40 + 30**	25	0.12
40 + 40	25	0.11
40 + 50**	25	0.10
50 + 50	25	0.09

\* Refer to sitework.

\*\* Where multiple layers of insulation of different thicknesses are used, the thickest layer should be installed as the outermost layer in the construction.

NB For the purposes of these calculations, the bridging effect Kingspan OPTIM-R® flex has been taken to be 20%. This figure is a starting point; for accurate calculations a design will be required and the bridging effect may change the U-values achieved.

# Typical constructions and U-values

Timber deck with plasterboard ceiling and Kingspan GreenGuard® overlay (heavy traffic areas)

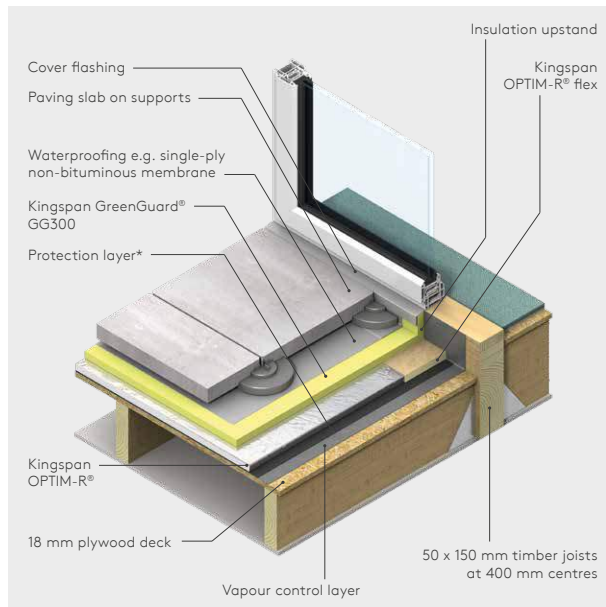


Figure 6

Kingspan OPTIM-R® thickness (mm)	Kingspan GreenGuard® GG300 overlay thickness (mm)	U-values (W/m <sup>2</sup> K)
20	30	0.28
25	30	0.25
30	30	0.22
40	30	0.18
50	30	0.16
30 + 30	30	0.14
40 + 30	30	0.12
40 + 40	30	0.11
40 + 50	30	0.10
50 + 50	30	0.09

\* Refer to sitework.

NB For the purposes of these calculations, the bridging effect Kingspan OPTIM-R® flex has been taken to be 20%. This figure is a starting point; for accurate calculations a design will be required and the bridging effect may change the U-values achieved.

## Metal deck

Metal deck with no ceiling

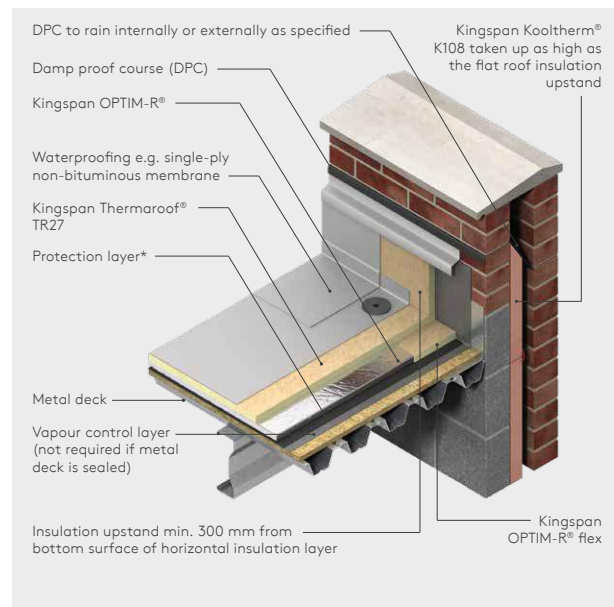


Figure 7

\* Refer to sitework.

\*\* Specification and thickness dependent on metal decking specification.

# Typical constructions and U-values

## Green roof systems

Extensive green roof covering - metal deck with no ceiling

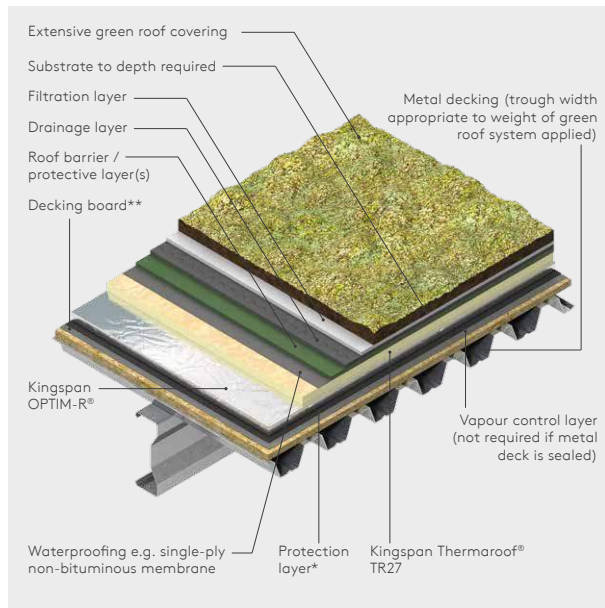


Figure 8

\* Refer to sitework.

\*\* Specification and thickness dependent on metal decking specification.

Semi-intensive green roof covering - dense concrete deck with suspended ceiling



Figure 9

\* Refer to sitework.

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# Design considerations

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## Linear thermal bridging

Reasonable provision must be made to limit the effects of cold bridging. Where upstands exist, Kingspan Thermaroof® TR27 or Kingspan GreenGuard® should be used around the perimeter of the terrace on the internal façade of the parapets to achieve a minimum thermal resistance of 1.10 m<sup>2</sup>K/W. A minimum distance of 300 mm should be maintained between the top of the insulation upstand and the bottom of the horizontal terrace insulation. Wall insulation should also be carried up into parapets as high as the flat roof insulation upstand.

Please contact the Kingspan Insulation Technical Service Department (see rear cover) for further advice.

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## Responsible sourcing

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

N.B. 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.

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## 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](mailto:literature@kingspaninsulation.co.uk).

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## Product classifications

Uniclass UK

Pr\_25\_57\_06\_94 Vacuum insulated panels

CAWS

J42 420, J42 430, (Standard and Intermediate)

J42 10, J31 10 (Minor Works)

Details also available at [NBS Source](#).

## Specification clause

The Kingspan OPTIM-R® Roofing System should be described in specifications as:-

The roof insulation shall be the Kingspan OPTIM-R® 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 product shall be manufactured under a management system certified to ISO 9001: 2015, ISO 14001: 2015, ISO 45001: 2018 and ISO 50001: 2018; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

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## Wind loading

Wind loadings 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) taking into account:

- length / width / height of the building;
- orientation of the building;
- wind speed;
- aspect (e.g. on a hill side); and
- topographical value of the surrounding area.

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## Falls

The fall on a flat roof, constructed using the Kingspan OPTIM-R® Roofing System, 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. These can be provided by Kingspan OPTIM-R® when used with an overlay of Kingspan Thermataper® TT47 (see below).

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## Tapered roofing

The Kingspan OPTIM-R® Roofing System can also be used in a tapered roofing scheme. The scheme comes with a supporting design service. This ensures that the most cost-effective solution for a roof is identified and that the end result is a tapered system design which meets a roof's rainwater run-off and insulation requirements. For more details please contact the Kingspan Insulation Tapered Roofing Department (see rear cover), which should be consulted as early as possible in the process of designing a roof.



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# Design considerations

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## Green roofs and green roof terraces

The Kingspan OPTIM-R® Roofing System is suitable for use under most warm green roof systems and roof terrace 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<sup>2</sup> 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 the 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.

Where these requirements cannot be ensured, the insulation must be bonded down (see Sitework). For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).

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## Roof waterproofing

Kingspan OPTIM-R®, when used in conjunction with an overlay of Kingspan Thermarroof® TR27, is suitable for use with most fully adhered single-ply waterproofing membranes. When using OPTIM-R® with fully adhered single-ply waterproofing membranes, the joints between the Thermarroof® TR27, immediately below the waterproofing membrane, can be taped with a min. 50 mm wide foil tape (refer to the appropriate single-ply membrane manufacturer's instructions). Please contact the Kingspan Insulation Technical Service Department (see rear cover) to check waterproofing membrane and proprietary adhesive system compatibility. Advice should be sought, from the appropriate waterproofing membrane manufacturer, in relation to the requirement for the use of a fleece backed membrane with the waterproofing membrane in question.

Kingspan OPTIM-R®, when used in conjunction with an overlay of Kingspan Thermarroof® TR27, is also suitable for use with some cold liquid applied waterproofing systems. When using OPTIM-R® with cold liquid applied waterproofing systems, a carrier membrane for the waterproofing must be installed over the Thermarroof® TR27. Advice should be sought, from the waterproofing system manufacturer, about the specification of the carrier membrane and the compatibility of the waterproofing system with OPTIM-R®. For further advice please contact the Kingspan Insulation Technical Service Department (see rear cover).

Kingspan OPTIM-R®, when used in conjunction with an overlay of Kingspan GreenGuard®, is suitable for use with most fleece backed single ply waterproofing membranes. The waterproofing membrane can be either fully adhered or loose laid when ballasted. Advice should be sought from the appropriate membrane manufacturer.

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## Water vapour control

Kingspan OPTIM-R® must be installed over a separate vapour control layer. A minimum vapour control layer should consist of a coated roofing felt complying with Type 3B to BS / I.S. EN 13707: 2013 (Flexible sheets for waterproofing. Reinforced bitumen sheets for roof waterproofing. Definitions and characteristics), or S1P1 to BS 8747: 2007 (Reinforced bitumen membranes (RBMs) for roofing. Guide to selection and specification). Alternative vapour control layers should be discussed with the Kingspan Insulation Technical Service Department (see rear cover).

Where the separate vapour control layer is to be bonded, allowance should be made for adequate bonding of the vapour control layer to the substrate, so as to provide a suitable surface upon which to lay the insulation panels and sufficient resistance to wind up-lift (see 'Wind loading').

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# Sitework

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## Installing over concrete decks

- Concrete decks should be clean, dry, without projections (including fixing heads etc.), steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- In order to ensure an adequate bond between the concrete deck and the vapour control layer, the concrete deck should be suitably primed, in accordance with the primer manufacturer's instructions, prior to the application of the adhesive system, used to bond the vapour control layer to the deck.
- Where one run of the specified vapour control layer laps another, there should be minimum 150 mm side and end overlaps, which should be adequately sealed.
- Turn up the vapour control layer at the edge of the roof to a height appropriate to the specified waterproofing membrane.
- A protection layer may be used under Kingspan OPTIM-R®. For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).
- The Kingspan OPTIM-R® panels should be laid chessboard pattern where practical, with joints lightly butted. There should be no gaps at abutments.
- Where runs of Kingspan OPTIM-R® do not accurately fit the dimension of the roof, the use of Kingspan OPTIM-R® flex is required to make up this difference. Each OPTIM-R® flex board is to be the same thickness as the OPTIM-R® panels.
- Both the Kingspan OPTIM-R® panels and the Kingspan OPTIM-R® flex boards should be bonded down using an appropriate proprietary adhesive system.
- At the perimeter of the roof and roof terrace where upstands or any other penetrations (e.g. roof-lights or ventilator kerbs) are present, Kingspan OPTIM-R® flex should be laid abutting these areas, in strips no less than 200 mm wide, to take account of building tolerances and to provide a zone to allow for peel restraint mechanical fixing of the membrane should it be required. Refer to the waterproofing manufacturer for guidance on appropriate peel restraint detailing.
- The Kingspan Thermarroof® TR27 or Kingspan GreenGuard® overlay should be laid as soon as possible to avoid exposure of Kingspan OPTIM-R® to direct foot traffic.
- The Kingspan Thermarroof® TR27 or Kingspan GreenGuard® overlay should be bonded to the upper surface of the Kingspan OPTIM-R® using an appropriate proprietary adhesive system prior to the application of the waterproof covering.
- Subject to project requirements, Where upstands exist Kingspan Thermarroof® TR27 or Kingspan GreenGuard® should be used around the perimeter of the terrace on the internal façade of the parapets to achieve a minimum thermal resistance of 1.10 m<sup>2</sup>K/W.
- A minimum distance of 300 mm should be maintained between the top of the insulation upstand and the bottom of the horizontal roof insulation.
- The waterproofing membrane is installed in accordance with the membrane manufacturer's instructions, over the whole insulated area including any insulation upstands, as soon as possible after laying the insulation boards.

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## Installing over plywood decks

- Plywood decks should be clean, dry, without projections (including fixing heads etc.), steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- In order to ensure an adequate bond between the plywood deck and the vapour control layer, the plywood deck should be suitably primed, in accordance with the primer manufacturer's instructions, prior to the application of the adhesive system, used to bond the vapour control layer to the deck.
- Where one run of the specified vapour control layer laps another, there should be minimum 150 mm side and end overlaps, which should be adequately sealed.
- Turn up the vapour control layer at the edge of the roof to a height appropriate to the specified waterproofing membrane.
- A protection layer may be used under Kingspan OPTIM-R®. For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).
- The Kingspan OPTIM-R® panels should be laid chessboard pattern where practical, with joints lightly butted. There should be no gaps at abutments.
- Where runs of Kingspan OPTIM-R® do not accurately fit the dimension of the roof, the use of Kingspan OPTIM-R® flex is required to make up this difference. Each OPTIM-R® flex board is to be the same thickness as the OPTIM-R® panels.
- Both Kingspan OPTIM-R® panels and the Kingspan OPTIM-R® flex strips should be bonded down using an appropriate proprietary adhesive system.

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# Sitework

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- At the perimeter of the roof and where upstands or any other penetrations (e.g. roof-lights or ventilator kerbs) are present, Kingspan OPTIM-R® flex should be laid abutting these areas, in strips no less than 200 mm wide, to take account of building tolerances and to provide a zone to allow for peel restraint mechanical fixing of the membrane should it be required. Refer to the waterproofing manufacturer for guidance on appropriate peel restraint detailing.
- The Kingspan ThermoRoof® TR27 or Kingspan GreenGuard® overlay should be laid as soon as possible to avoid exposure of Kingspan OPTIM-R® to direct foot traffic.
- The Kingspan ThermoRoof® TR27 or Kingspan GreenGuard® overlay should be bonded to the upper surface of the Kingspan OPTIM-R® panels using an appropriate proprietary adhesive system prior to the application of the waterproof covering.
- Where upstands exist Kingspan ThermoRoof® TR27 or Kingspan GreenGuard® should be used around the perimeter of the terrace on the internal façade of the parapets to achieve a minimum thermal resistance of 1.10 m<sup>2</sup>K/W.
- A minimum distance of 300 mm should be maintained between the top of the insulation upstand and the bottom of the horizontal roof insulation.
- The waterproofing membrane is installed in accordance with the membrane manufacturer's instructions, over the whole insulated area including any insulation upstands, as soon as possible after laying the insulation boards.

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## Installing over metal decks, existing flat roofs and existing composite roof panels

- Kingspan OPTIM-R® is suitable for use over metal decks, existing flat roofs and existing composite roof panels. For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).

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## Wheeled / foot traffic

- Kingspan OPTIM-R® panels should not be walked on. A protective foot or crawl board should be used during the installation process.
- Kingspan OPTIM-R® flex boards and the Kingspan ThermoRoof® TR27 or Kingspan GreenGuard® overlay may be walked on.

## General

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

## Cutting

- Kingspan OPTIM-R® panels should not be cut or penetrated.
- The substrate must be clean, dry and level, and free of sharp objects or edges.
- Cutting of the Kingspan OPTIM-R® flex boards 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 the Kingspan OPTIM-R® flex boards to achieve close-butting joints and continuity of insulation.

## Availability

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

## Packaging and storage

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

## 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](http://www.kingspaninsulation.co.uk/safety) or [www.kingspaninsulation.ie/safety](http://www.kingspaninsulation.ie/safety).

Please note that the reflective surface on this product is designed to enhance its thermal performance. As such, it will reflect light as well as heat, including ultraviolet light.

Therefore, if this panel is being installed during very bright or sunny weather, it is advisable to wear UV protective sunglasses or goggles, and if the skin is exposed for a significant period of time, to protect the bare skin with a UV block sun cream.

The reflective facing used on this product can be slippery underfoot when wet. Therefore, it is recommended that any excess material should be contained to avoid a slip hazard.

# Product details

## Composition

Kingspan OPTIM-R® comprises a rigid vacuum insulation panel with a microporous core which is evacuated, encased and sealed in a thin, gas-tight envelope.

Kingspan OPTIM-R® flex comprises of a high performance rigid thermoset polyisocyanurate (PIR) insulant, faced on both sides with a coated glass tissue.

## Standards & approvals

The Kingspan OPTIM-R® Roofing System 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 45001: 2018 (Occupational health and safety management systems) and ISO 50001: 2018 (Energy management systems).

The use of Kingspan OPTIM-R® is covered by BDA Agrément Certificate BAE 18-035-P-A-UK (in thicknesses of 20 - 50 mm) and ETA Certificate No. ETA-15/0090-v06.



## Standard dimensions

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

Nominal dimension		Availability
Length	(mm)	300 - 1200
Width	(mm)	300 - 600
Insulant Thickness	(mm)	20 - 50

Other sizes may be available dependent on order quantity. Please contact Kingspan Insulation for more details.

## Compressive strength

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

## Durability

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

## Resistance to solvents, fungi & rodents

The Kingspan OPTIM-R® 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® Roofing System resist attack by mould and microbial growth, and do not provide any food value to vermin.

## Fire performance

For guidance regarding the routes to compliance for meeting the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at [www.kingspaninsulation.co.uk/fireregulations](http://www.kingspaninsulation.co.uk/fireregulations) (for GB) or contact technical services at [technical@kingspaninsulation.ie](mailto:technical@kingspaninsulation.ie) (for Ireland).

Kingspan OPTIM-R® 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).

Under System 4 AVCP, Kingspan Therमारoof® TR27 has a Euroclass rating of F.

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

There can be materials placed above the insulation layer within a roofing system including, but not limited to, waterproofing materials, reinforcement layers, primers and carrier membranes. These additional materials complete the roofing system. As such, the fire performance of a roofing system is predominantly determined by these finishes in combination with the insulation.

Compliance for meeting the fire safety requirements of the Building Regulations / Standards can be evaluated by testing the fire performance of the roofing system. The most commonly used route to compliance involves testing the full roofing system and uses test method DD CEN/ TS 1187: 2012 (Test methods for external fire exposure to roofs). External roof exposure testing is typically carried out by the waterproofing manufacturer / system supplier, due to the complexities of the roofing system outlined above.

# Product details

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  $\geq 80 \text{ kg/m}^2$  (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.

NB Test evidence to demonstrate compliance with the fire safety requirements of the Building Regulations / Standards incorporating Kingspan OPTIM-R® within a roof system should be provided by the chosen waterproofing system supplier. Without the required classification for the proposed roof system, achieved through either an external roof exposure test or an overlay of inorganic material, the use of OPTIM-R® must be restricted to at least 20 metres in England and 24 metres in Scotland, or more from any point of the relevant boundary.

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

## Thermal properties

The  $\lambda$ -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 declared value.

### Thermal conductivity

Kingspan OPTIM-R® achieves a thermal conductivity ( $\lambda$ -value) of 0.007 W/mK.

### Thermal resistance

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

Insulant thickness (mm)	Thermal resistance ( $\text{m}^2\text{K/W}$ )
20	2.85
25	3.55
30	4.25
40	5.70
50	7.10

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