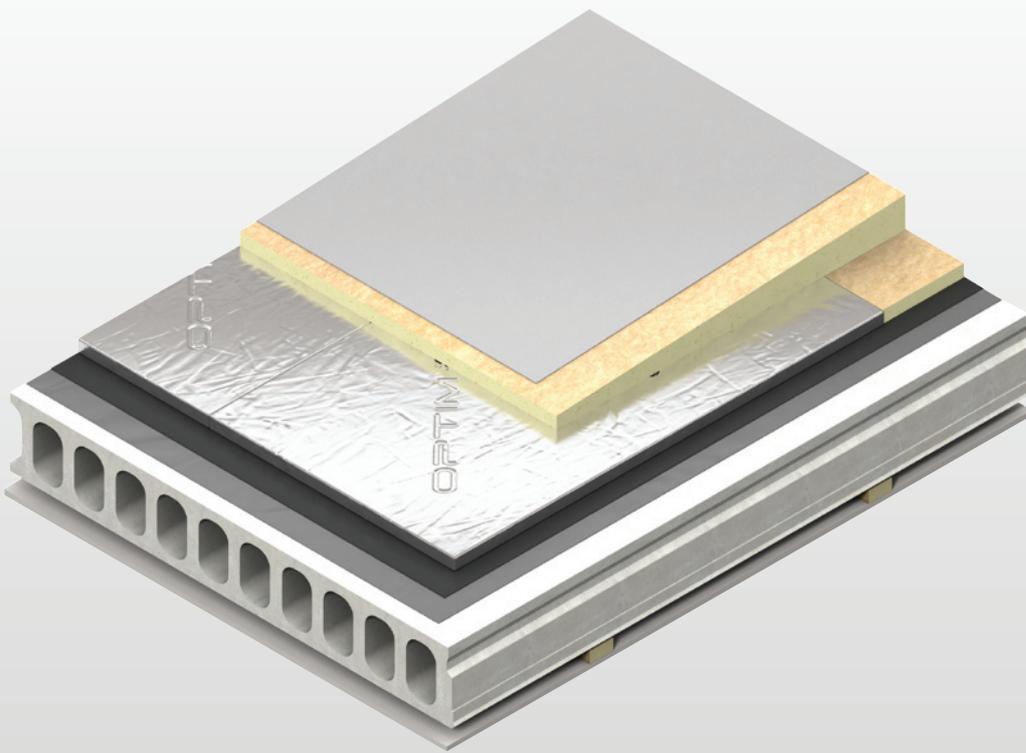




OPTIM-R™ Roofing System

NEXT GENERATION INSULATION SOLUTION
FOR FLAT ROOFS



- Optimum performance rigid vacuum insulation panel – aged design value thermal conductivity 0.007 W/m·K
- Insulating performance up to five times better than other commonly available insulation materials
- Over 90% (by weight) recyclable
- Resistant to the passage of water vapour
- Ideal for new build and refurbishment
- Non-deleterious material



*Low Energy –
Low Carbon Buildings*

Introduction

The problem

When constructing a roof in new build situations or replacing a roof 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.

The solution

The **Kingspan OPTIM-R™ Roofing System** has been developed to help solve these problems. The **Kingspan OPTIM-R™ Roofing System** is an optimum performance next generation insulation solution from Kingspan Insulation. It comprises of rigid vacuum insulation panels with a micro-porous 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. 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 or ventilator kerbs.

In retrofit applications, the **Kingspan OPTIM-R™ Roofing System** provides solutions for areas that previously would have remained un-insulated because of insufficient space available.

In new constructions, the **Kingspan OPTIM-R™ Roofing System** can significantly enhance U-values in areas that would otherwise be accepted as denigrating the overall thermal performance.

With an aged design value thermal conductivity (λ) of 0.007 W/m·K, the **Kingspan OPTIM-R™** element of the **Roofing System** provides an insulating performance that is up to five times better than other commonly available insulation materials.

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

Design considerations

Design services

The **Kingspan OPTIM-R™ Roofing System** comes with a supporting design service which ensures the ratio of the **Kingspan OPTIM-R™** element of the Roofing System to the **Kingspan OPTIM-R™ Roofing System** infill panel 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™** panels. It will also illustrate the size, number and location of any **Kingspan OPTIM-R™ Roofing System** infill panels required. Examples of a typical design layout can be seen in Figures 1 & 3.

For more details please contact the Kingspan Insulation Techline (see rear cover).

Condensation risk analysis

Included in the design service is the calculation of condensation risk in accordance with ISO 13788 (Code of practice for control of condensation in buildings). This ensures that any predicted dew point is above the vapour control layer at the point of minimum thickness of the **Kingspan OPTIM-R™ Roofing System**, whilst also ensuring any condensation risk is within the limits given.

Assumptions

The U-values in the tables that follow have been calculated, under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U-value and Condensation Risk Calculations, using the method detailed in EN ISO 6946 (Building components and building elements. Thermal resistance and thermal transmittance. 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 Techline for assistance (see rear cover).

Typical roofing designs for the *Kingspan OPTIM-R™* Roofing System

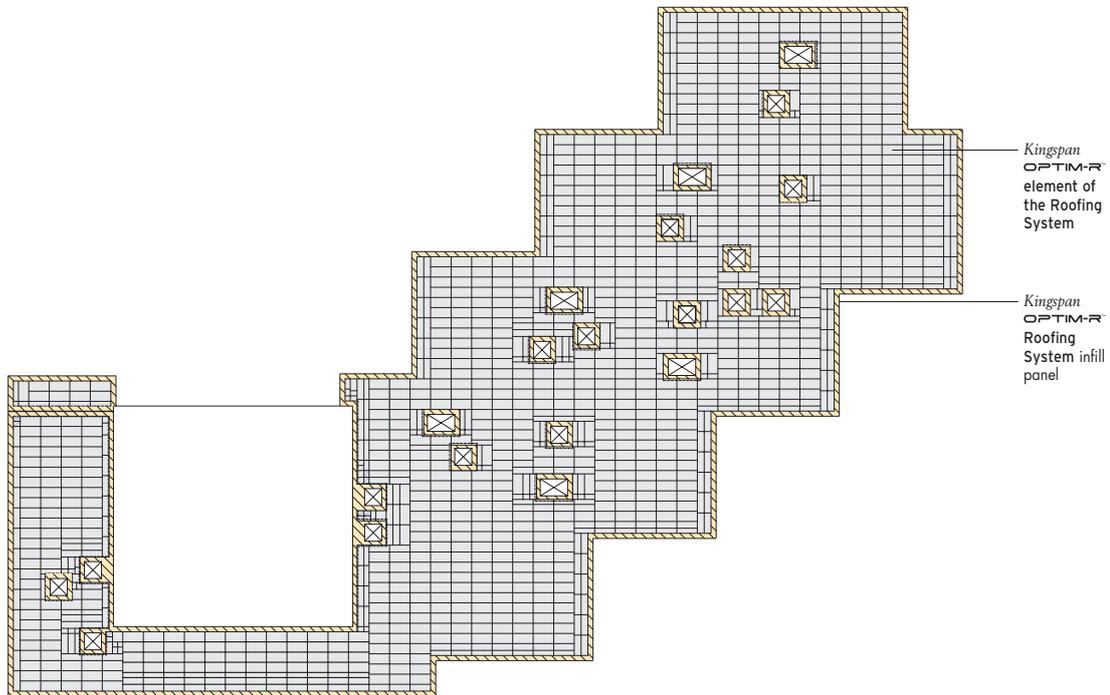


Figure 1

Concrete deck

Dense concrete deck with suspended ceiling

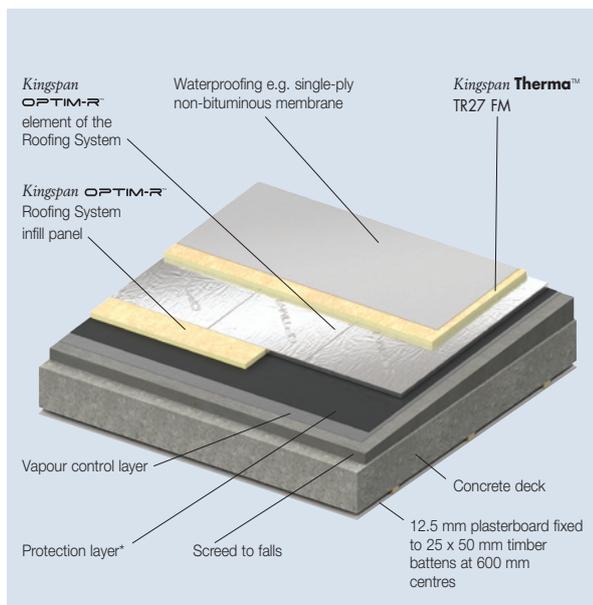


Figure 2

* Refer to Sitework.

The *Kingspan OPTIM-R™* Roofing System, when used in the design in Figure 1 and when installed on top of a dense concrete deck with suspended ceiling (Figure 2), can achieve the following U-values using a combined thickness of both the *Kingspan OPTIM-R™* Roofing System and a *Kingspan Thermo™* TR27 FM overlay:

<i>Kingspan OPTIM-R™</i> Roofing System thickness (mm)	<i>Kingspan Thermo™</i> TR27 FM overlay thickness (mm)	U-values (W/m ² ·K)**
40	25	0.16
50	25	0.14
50	30	0.13
30 + 30	25	0.12
40 + 30	25	0.11
40 + 30	30	0.10
40 + 40	25	0.09

* Based on 11% bridging of the *Kingspan OPTIM-R™* Roofing System infill panel.

** The calculated U-values are in accordance with EN 6946.

Design considerations

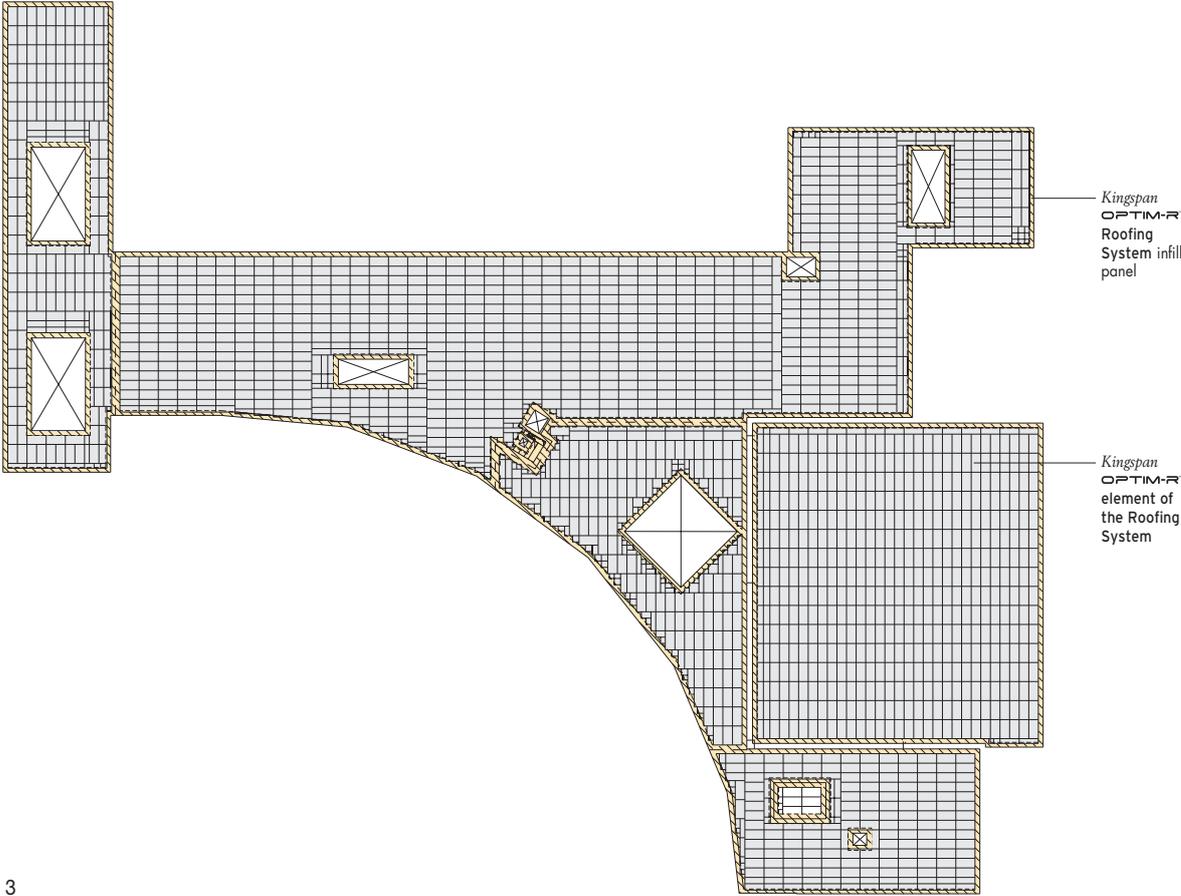


Figure 3

Timber deck

Timber deck with plasterboard ceiling

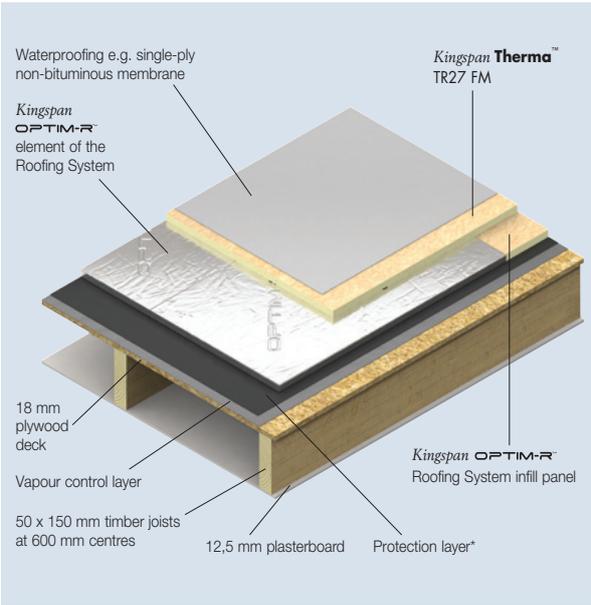


Figure 4

* Refer to Sitework.

The **Kingspan OPTIM-R™ Roofing System**, when used in the design in Figure 3 and when used on top of a timber deck with plasterboard ceiling (Figure 4), can achieve the following U-values using a combined thickness of both the **Kingspan OPTIM-R™ Roofing System** and a **Kingspan Therma™ TR27 FM** overlay:

Kingspan OPTIM-R™ Roofing System thickness (mm)	Kingspan Therma™ TR27 FM overlay thickness (mm)	U-values (W/m²·K)**
40	25	0.16
50	25	0.14
50	30	0.13
30 + 30*	25	0.12
40 + 30*	25	0.10
40 + 30*	30	0.10
40 + 40*	25	0.09

* Based on 10.37% bridging of the **Kingspan OPTIM-R™ Roofing System** infill panel.
 ** The calculated U-values are in accordance with EN 6946.

Linear thermal bridging

Reasonable provision must be made to limit the effects of cold bridging. The design should ensure that roof-light or ventilator kerbs etc. are insulated with a 25 mm thick *Kingspan Therma™ TR27 FM* board. A 25 mm thick *Kingspan Therma™ TR27 FM* 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. Wall insulation should also be carried up into parapets as high as the flat roof insulation upstand.

Please contact the Kingspan Insulation Techline (see rear cover) for further advice.

Responsible sourcing

The *Kingspan OPTIM-R™ Roofing System* is manufactured under a management system certified to ISO 14001.

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.

Wind loading

Wind loadings should be assessed in accordance with local building standards and or EN 1991-1-4 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.

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 please refer to local building codes. The fall can be provided by the *Kingspan OPTIM-R™ Roofing System* when used with an overlay of *Kingspan Therma™ TT47 FM* (see below).

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 Techline (see rear cover), which should be consulted as early as possible in the process of designing a roof.

Green roofs

The *Kingspan OPTIM-R™ Roofing System* is suitable for use under most warm 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.

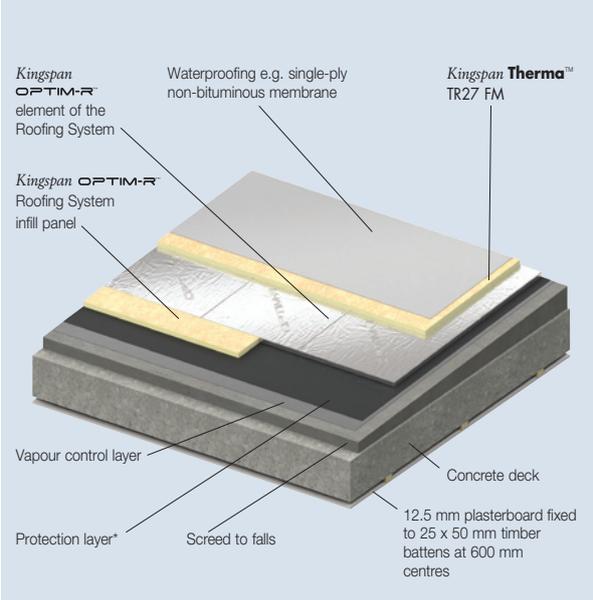
The total required dry weight will depend upon wind uplift, which in turn will vary with the geographical location of the building, local topography, and the height and the width of the roof concerned. The necessity for any additional dry weight should be assessed in accordance with local building codes or EN 1991-1-4.

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

Typical constructions

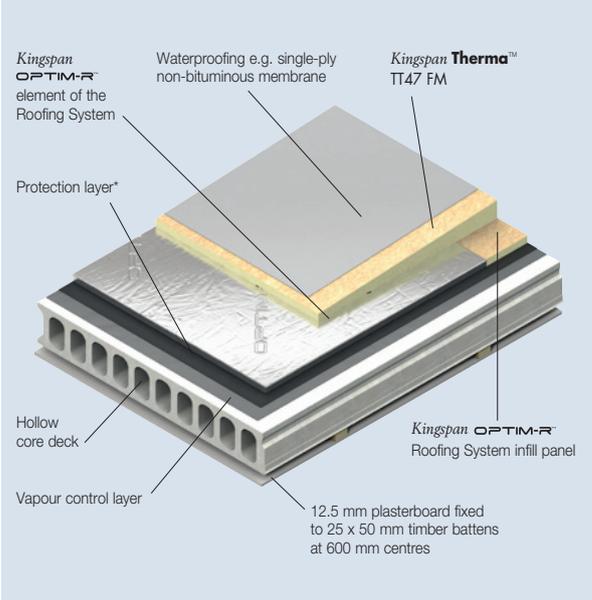
Concrete deck

Dense concrete deck with suspended ceiling



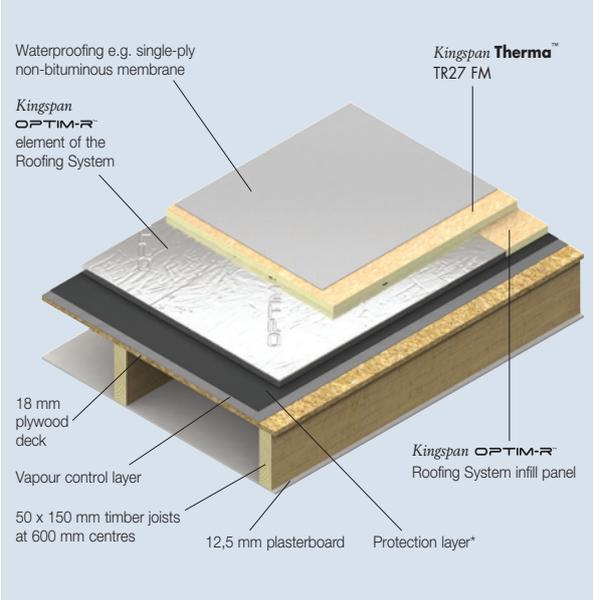
Hollow core deck

Hollow core deck plasterboard ceiling



Timber deck

Timber deck with plasterboard ceiling



Design considerations

Roof waterproofing

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

Water vapour control

The *Kingspan OPTIM-R™ Roofing System* must be installed over a separate vapour control layer. Vapour control layers should be discussed with the Kingspan Insulation Techline (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').

Sitework

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 according to the instructions of the manufacturer.
- Turn up the vapour control layer at the edge of the roof to a height appropriate to the specified waterproofing membrane.
- An optional protection layer may be used under the *Kingspan OPTIM-R™ Roofing System*. For further information please contact the Kingspan Insulation Techline (see rear cover).
- The *Kingspan OPTIM-R™* element of the Roofing System should be laid chessboard pattern where practical, with joints lightly butted. There should be no gaps at abutments.
- Where runs of the *Kingspan OPTIM-R™* element of the Roofing System do not accurately fit the dimension of the roof, the use of *Kingspan OPTIM-R™ Roofing System* infill boards are required to make up this difference. Each *Kingspan OPTIM-R™ Roofing System* infill panel is to be the same thickness as the *Kingspan OPTIM-R™* element of the Roofing System.
- Both the *Kingspan OPTIM-R™* element of the Roofing System and the *Kingspan OPTIM-R™ Roofing System* infill panels should be bonded down using an appropriate proprietary adhesive system.
- 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™ Roofing System* infill panels 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 Therma™ TR27 FM* infill panels should be laid as soon as possible to avoid exposure of the *Kingspan OPTIM-R™* element of the Roofing System to direct foot traffic.
- The *Kingspan Therma™ TR27 FM* should be bonded to the upper surface of the *Kingspan OPTIM-R™* element of the Roofing System using an appropriate proprietary adhesive system prior to the application of the waterproof covering.
- Subject to project requirements, a minimum 25 mm thick *Kingspan Therma™ TR27 FM* 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.
- 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.

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 according to the instructions of the manufacturer.
- Turn up the vapour control layer at the edge of the roof to a height appropriate to the specified waterproofing membrane.
- An optional protection layer may be used under the *Kingspan OPTIM-R™ Roofing System*. For further information please contact the Kingspan Insulation Techline (see rear cover).
- The *Kingspan OPTIM-R™* element of the Roofing System should be laid chessboard pattern where practical, with joints lightly butted. There should be no gaps at abutments.
- Where runs of the *Kingspan OPTIM-R™* element of the Roofing System do not accurately fit the dimension of the roof, the use of *Kingspan OPTIM-R™ Roofing System* infill boards are required to make up this difference. Each *Kingspan OPTIM-R™ Roofing System* infill panel is to be the same thickness as the *Kingspan OPTIM-R™* element of the Roofing System.
- Both the *Kingspan OPTIM-R™* element of the Roofing System and the *Kingspan OPTIM-R™ Roofing System* infill panels should be bonded down using an appropriate proprietary adhesive system.
- 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™ Roofing System* infill panels 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 Therma™ TR27 FM* infill panels should be laid as soon as possible to avoid exposure of the *Kingspan OPTIM-R™* element of the Roofing System to direct foot traffic.
- The *Kingspan Therma™ TR27 FM* should be bonded to the upper surface of the *Kingspan OPTIM-R™* element of the Roofing System using an appropriate proprietary adhesive system prior to the application of the waterproof covering.
- Subject to project requirements, a minimum 25 mm thick *Kingspan Therma™ TR27 FM* 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.
- 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.

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

- The *Kingspan OPTIM-R™ Roofing System* is suitable for use over metal decks, existing flat roofs and existing composite roof panels. For further information please contact the Kingspan Insulation Techline (see rear cover).

Sitework

Wheeled / foot traffic

- The *Kingspan OPTIM-R™* element of the Roofing System should not be walked on. A protective foot or crawl board should be used during the installation process.
- The *Kingspan OPTIM-R™ Roofing System* infill panels and the *Kingspan Therma™ TR27 FM* overlay may be walked on.

General

- The *Kingspan OPTIM-R™* element of the Roofing System should not be used in association with solvent-based adhesive systems.
- The *Kingspan OPTIM-R™* element of the Roofing System should not be exposed to flames or excessive heat.

Cutting

- The *Kingspan OPTIM-R™* element of the Roofing System 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™ Roofing System* infill panels 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™ Roofing System* infill panels 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™ Roofing 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.eu/downloads

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

The *Kingspan OPTIM-R™* element of the Roofing System comprises a rigid vacuum insulation panel with a microporous core which is evacuated, encased and sealed in a thin, gas-tight envelope.

The *Kingspan OPTIM-R™* Roofing System infill panels comprise of a high performance rigid thermoset polyisocyanurate (PIR) insulant, faced on both sides with a coated glass tissue.

Standards and approvals

The *Kingspan OPTIM-R™* Roofing System is manufactured to the highest standards under a management system certified to ISO 9001 (Quality Management Systems. Requirements), ISO 14001 (Environmental Management Systems. Requirements) and OHSAS 18001 (Health and Safety Management Systems. Requirements).

Standard dimensions

The *Kingspan OPTIM-R™* Roofing System panels are available in the following standard size(s):

Nominal dimension	Availability
Length (mm)	300 – 1200
Width (mm)	300 – 600
Insulant Thickness (mm)	20 – 40

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

Compressive strength

The compressive strength of the *Kingspan OPTIM-R™* element of the Roofing System typically exceeds 160 kPa at 10% compression when tested to EN ISO 826 (Thermal insulating products for building application. 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

The *Kingspan OPTIM-R™* Roofing System, has a reaction to fire class C-S1, d2 in accordance with EN 13501.

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

Thermal properties of the *Kingspan OPTIM-R™* element of the roofing system

The λ -values and R_M -values detailed below are quoted in accordance with EN 12667 (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

The *Kingspan OPTIM-R™* element of the Roofing System achieves a thermal conductivity (λ -value) of 0.007 W/m·K (aged design value allowing for edge effect).

Thermal resistance

Thermal resistance (R_M -value) of the *Kingspan OPTIM-R™* element of the Roofing System varies with thickness and is calculated by dividing the thickness of the panel (expressed in metres) by the thermal conductivity.

Insulant thickness (mm)	R_M -value (m ² ·K/W)
20	2.857
25	3.571
30	4.285
40	5.714

Contact details

Customer service

Contact our sales department for price offers, orders, documentation and samples. You can reach us from Monday till Friday from 08.00 until 17.30 hrs.

Tel: +31 (0) 543 543 210
Fax: +31 (0) 344 675 215
email: info@kingspaninsulation.eu

Sales Office

Kingspan Insulation B.V.
P.O. Box 6175
4000 HD Tiel
Netherlands

Technical service

Kingspan Insulation has one of the most technically advanced support services in the industry offering a full spectrum of advice, free of charge on both newbuild and refurbishment projects. The Kingspan Insulation technical team are continually updating their knowledge on building trends, construction methods and the development of building materials to ensure the advice and services provided are always one step ahead.

Services available:

- R and U-value calculations.
- Advice on product selection and product data for the full range of Kingspan Insulation products.
- Installation and fixing advice on all applications and products.
- Specification and construction advice.
- Tapered roofing design service

You can reach our Techline from Monday till Friday from 08.00 until 17.00 hrs.

Tel: 00800 – 5464 7726
Fax: +31 (0) 344 675 215
email: techline@kingspaninsulation.eu

The physical and chemical properties of the products of Kingspan Insulation B.V. represent average values, that have been obtained during generally accepted testing methods, submitted to normal product tolerances. Kingspan Insulation B.V. reserves the right to amend product specifications without prior notice. The information, technical details, fixing instructions etc. included in this literature are handed out in good faith and are consistent with the application targeted by Kingspan Insulation B.V. The images in this document are only meant to give a global impression of the looks of the product and show one out of many applications possible. Kingspan Insulation B.V. does not guarantee that the shown applications are in accordance with valid (local) regulations. Recommendations for use should be verified as to the suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation B.V. offers a Technical Advisory Service the advice of which should be sought for uses of Kingspan Insulation products that are not specifically described herein. Please check that your copy of the literature is current by contacting the Kingspan Insulation Marketing Department.



Kingspan Insulation B.V.

Lorentzstraat 1, 7102 JH Winterswijk, Netherlands
P.O. Box 198, 7100 AD Winterswijk, Netherlands

www.kingspaninsulation.eu