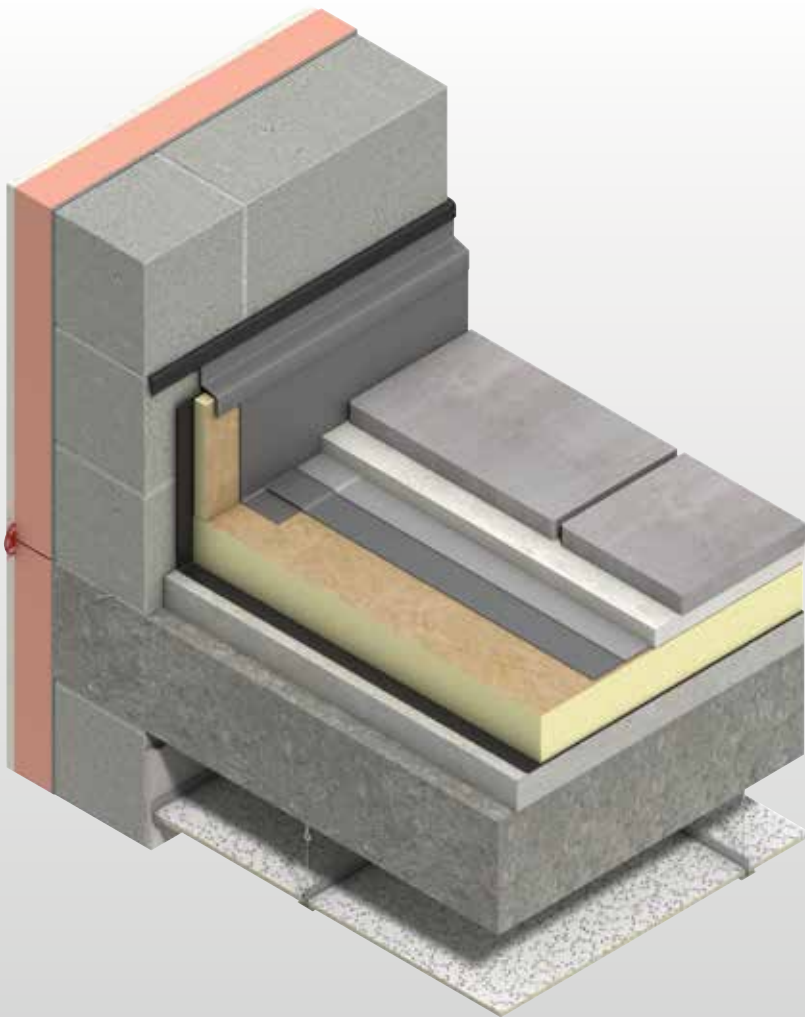




See rear cover for applicable countries

Thermarroof™ TR27 LPC/FM

INSULATION FOR FLAT ROOFS WATERPROOFED WITH FULLY ADHERED SINGLE-PLY AND COLD LIQUID APPLIED WATERPROOFING



- High performance rigid thermoset insulation – thermal conductivities as low as 0.022 W/m-K
- LPCB approved to LPS 1181: Part 1
- FM approved for Class 1 steel deck roof assemblies
- Fully compatible with single-ply non-bituminous membranes that are fully bonded with solvent based adhesive systems
- Compatible with most green roof systems
- Resistant to the passage of water vapour
- Easy to handle and install
- Ideal for new build and refurbishment
- Non-deleterious material
- Manufactured with a blowing agent that has zero ODP and low GWP
- Approved by the State of Qatar Ministry of Interior General Admin of Civil Defence



LPS 1181: Part 1
Certificate No.
388b/01



APPROVED
Class 1 Roof
Construction



Low Energy –
Low Carbon Buildings

Typical Constructions and U-values

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 BS / I.S. EN ISO 6946: 2007 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method) and using the conventions set out in BR443 (Conventions for U-value calculations). They are valid for the constructions shown in the details immediately above each table.



These examples are based on **Kingspan Thermaroof™ TR27 LPC/FM** waterproofed using either a fully adhered single-ply membrane or under a cold liquid applied waterproofing system. The insulation board is: fully bonded to a sealed metal deck, or a vapour control layer, which has itself been fully bonded to the type of deck stated for each application; or mechanically fixed through a sealed metal deck, or a vapour control layer, which has itself been loose-laid directly over the type of deck stated for each application.

NB When calculating U-values to BS EN ISO 6946: 2007, the type of mechanical fixing used may change the thickness of insulation required. These calculations assume telescopic tube fasteners with a thermal conductivity of 1.00 W/m·K or less, the effect of which is insignificant.

NB 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.

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

NB If your construction is different from those specified and / or to gain a comprehensive U-value calculation along with a condensation risk analysis for your project please consult Kingspan Insulation for assistance (see rear cover).

U-value Table Key

Where an **x** is shown, the U-value is higher than the worst of the maximum new build area weighted average U-values allowed by the Green Building Code (Dubai), Estidama (Abu Dhabi), GSAS (Qatar) and other regulations across the Middle East.

Concrete Deck

Dense Concrete Deck with Dropped Ceiling

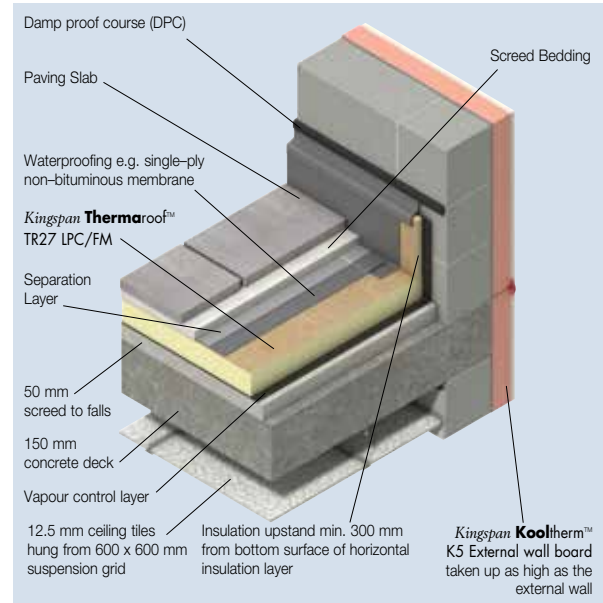


Figure 1

U-values (W/m²·K) for Various Thicknesses of **Kingspan Thermaroof™ TR27 LPC/FM** with Fully Adhered Single Ply / Cold Liquid Applied Waterproofing Systems

Insulant Thickness (mm)	U-values (W/m ² ·K)
60	x
70	0.29
80	0.26
90	0.23
100	0.21
110	0.19
120	0.18
130	0.16
140	0.15
150	0.14
80 + 80	0.13
80 + 90*	0.12

Table 1: Thicknesses of **Kingspan Thermaroof™ TR27 LPC/FM**, installed within the construction shown in the image above. to meet the associated U-value.

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

Metal Deck

Metal Deck with No Ceiling

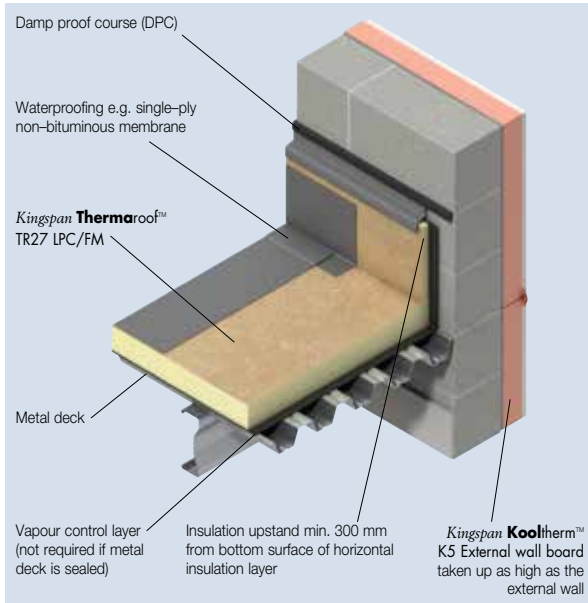


Figure 3

U-values (W/m ² ·K) for Various Thicknesses of <i>Kingspan Thermaroof™</i> TR27 LPC/FM with Fully Adhered Single Ply / Cold Liquid Applied Waterproofing Systems	
Insulant Thickness (mm)	U-values (W/m ² ·K)
60	X
70	0.30
80	0.26
90	0.24
100	0.21
110	0.19
120	0.18
130	0.17
140	0.15
150	0.14
80 + 80	0.13
80 + 90*	0.12

Table 2: Thicknesses of *Kingspan Thermaroof™* TR27 LPC/FM, installed within the construction shown in the image above. to meet the associated U-value.

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

Green Roof Systems

Extensive Green Roof Covering – Metal Deck with No Ceiling

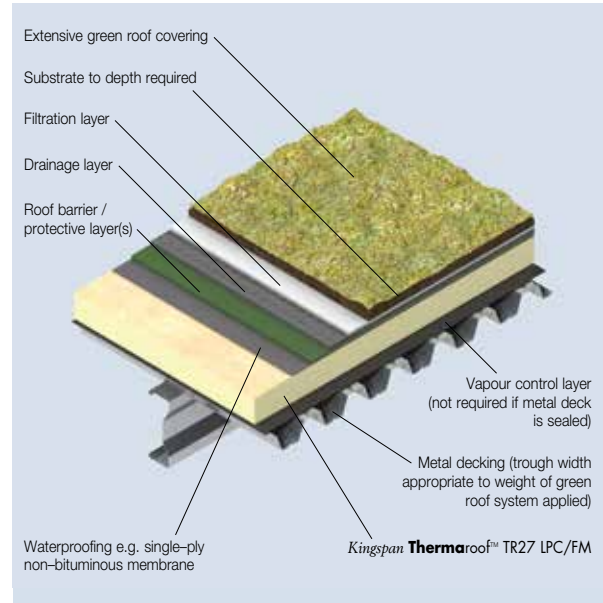


Figure 4

U-values (W/m ² ·K) for Various Thicknesses of <i>Kingspan Thermaroof™</i> TR27 LPC/FM with Fully Adhered Single Ply / Cold Liquid Applied Waterproofing Systems	
Insulant Thickness (mm)	U-values (W/m ² ·K)
60	X
70	0.30
80	0.26
90	0.24
100	0.21
110	0.19
120	0.18
130	0.17
140	0.15
150	0.14
80 + 80	0.13
80 + 90*	0.12

Table 3: Thicknesses of *Kingspan Thermaroof™* TR27 LPC/FM, installed within the construction shown in the image above. to meet the associated U-value.

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

Semi-intensive Green Roof Covering – Dense Concrete Deck with No Ceiling

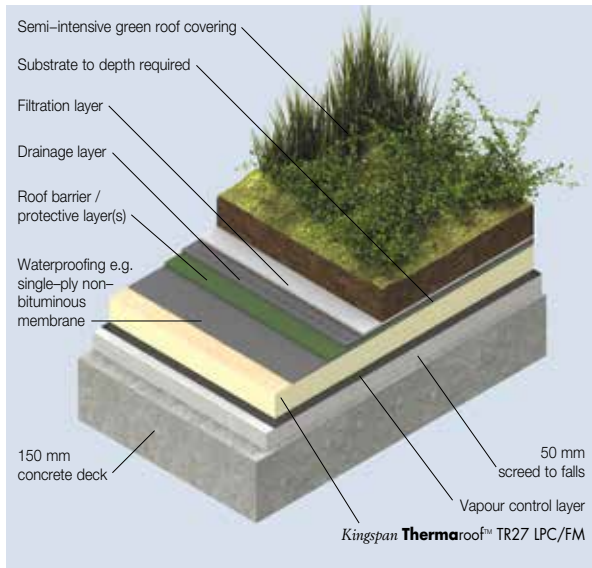


Figure 5

U-values ($W/m^2 \cdot K$) for Various Thicknesses of *Kingspan Thermaroof™ TR27 LPC/FM* with Fully Adhered Single Ply / Cold Liquid Applied Waterproofing Systems

Insulant Thickness (mm)	U-values ($W/m^2 \cdot K$)
60	X
70	0.29
80	0.26
90	0.23
100	0.21
110	0.19
120	0.18
130	0.16
140	0.15
150	0.14
80 + 80	0.13
80 + 90*	0.12

Table 4: Thicknesses of *Kingspan Thermaroof™ TR27 LPC/FM*, installed within the construction shown in the image above, to meet the associated U-value.

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

Design Considerations

Linear Thermal Bridging

Reasonable provision must be made to limit the effects of thermal bridging. The design should ensure that roof-light or ventilator kerbs etc. are always insulated with the same thickness of **Kingspan Thermaroof™ TR27 LPC/FM** as the general roof area. A 25 mm thick **Kingspan Thermaroof™ TR27 LPC/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 at least as high as the flat roof insulation upstand. Please contact Kingspan Insulation (see rear cover) for further advice.

Environmental Impact & Responsible Sourcing

Green Guide Rating

An Ecoprofile, certified by BRE Certification to the 2008 BRE Environmental Profiles Methodology, has been created for **Kingspan Thermaroof™ TR27 LPC/FM** produced at Kingspan Insulation's British manufacturing facilities.

The BRE has assigned the product a 2008 Green Guide Summary Rating of A.



Environmental Profiles Scheme
Certificate Number ENP 409

Kingspan Thermaroof™ TR27 LPC/FM manufactured at Kingspan Insulation's Pembridge, UK manufacturing facility is certified to BES 6001 'Excellent'.



NB The above information is correct at the time of writing. Please confirm at the point of need by contacting Kingspan Insulation (see rear cover), from which copies of Kingspan Insulation's and its suppliers' BES 6001 certificates can be obtained, along with confirmation of Kingspan Insulation's products' Green Guide Ratings.

Responsible Sourcing

Kingspan Thermaroof™ TR27 LPC/FM is manufactured under a management system certified to ISO 14001: 2004. The principle polymer components of the product are also manufactured under management systems certified to ISO 14001: 2004.

Sustainability & Responsibility

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

A report covering the sustainability and responsibility of Kingspan Insulation's British operations is available at www.kingspaninsulation.co.uk/sustainabilityandresponsibility.

Specification Clause

Kingspan Thermaroof™ TR27 LPC/FM should be described in specifications as:-

The roof insulation shall be **Kingspan Thermaroof™ TR27 LPC/FM** ___mm thick: comprising a fibre-free high performance rigid thermoset insulation core faced on both sides with a coated glass tissue facing. The product shall be manufactured: with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP); in accordance with the requirements of BS 4841-3 and BS 4841-4; under a management system certified to ISO 9001: 2008, ISO 14001: 2004 and BS / I.S. OHSAS 18001: 2007; by Kingspan Insulation and installed in accordance with the instructions issued by them.

Wind Loading

Wind loadings should be assessed in accordance with BS 6399-2: 1997 (Loadings for buildings. Code of practice for wind loads) or BS / I.S. EN 1991-1-4: 2005 (National Annex to Eurocode 1 Actions on Structures. 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.

Falls

The fall on a flat roof, constructed using **Kingspan Thermaroof™ TR27 LPC/FM**, 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: 2003 (Flat roofs with continuously supported 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 a **Kingspan Thermataper™ LPC/FM** tapered roofing system (see below).

Tapered Roofing

*Kingspan Therma*roof™ TR27 LPC/FM is also available in a tapered version, *Kingspan Therma*taper™ TT47 LPC/FM, comprising a fibre-free high performance rigid thermoset insulation core, manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP), faced on both sides with a coated glass tissue facing.

The Problem

There are many critical factors which must be taken into consideration when designing a flat roof construction. Two of these factors, insulation and rainwater run-off, can be addressed with one product range: *Therma*taper™ LPC/FM from Kingspan Insulation.

The Solution

*Kingspan Therma*taper™ LPC/FM Systems have been developed to help solve these problems. *Kingspan Therma*taper™ LPC/FM Systems comprise tapered Insulation boards, flat packer boards, pre-mitred hip and valley boards and a tapered roofing design service. *Kingspan Therma*taper™ LPC/FM products are designed: for use under most waterproofing membranes; to provide required roof falls; and to provide Insulation to meet the requirements of Building Regulations / Standards.

The Benefits

Simpler - on new roofs, the use of a *Kingspan Therma*taper™ LPC/FM System eliminates the need to incorporate a fall into the design of the roof deck. On existing roofs, a *Kingspan Therma*taper™ LPC/FM and a new waterproofing membrane can be laid on top of the original waterproofing. This eliminates the need for stripping down the roof to deck level, and the provision of a vapour control layer may not be required

NB The existing insulation / substrate and water proofing must be sound, in order to provide a satisfactory surface for the *Kingspan Therma*taper™ LPC/FM Systems, and the risk of interstitial condensation must be fully assessed.

Cheaper - Using a *Kingspan Therma*taper™ LPC/FM System to achieve a U-value of 0.16 W/m².K could be up to, or over, 26% cheaper than using alternative methods (e.g. screed) to create a fall in a flat roof for rainwater drainage purposes.

Quicker - *Kingspan Therma*taper™ LPC/FM Systems avoid a wet trade and do not need time to dry out, saving time in the scheduling of a construction project.

Lighter - *Kingspan Therma*taper™ LPC/FM Systems are also a lighter weight alternative to screeding and they do not present the risk of an overloaded structure due to excessive screed depths. *Kingspan Therma*taper™ LPC/FM Systems can be as little as 1.5%, or less, of the weight of a solution using screed to falls with a flat insulation board.

Less waste - pre-mitred boards reduce waste from the installation process. Insulation boards are cut in half by Kingspan Insulation in its factory to make mitred hip and valley boards.

These are single picked to match the tapered system design so as to reduce waste from cutting hips and valleys on site. Both (hip and valley) halves of the cut board are used and the only waste is the dust generated by sawing. Whereas, when boards are cut on site, up to 50% of the cut boards could be wasted, depending on the particulars of the specific board layout and falls design.

Design Services

*Kingspan Therma*taper™ LPC/FM Systems come 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 the roof's rainwater run-off and insulation requirements.

Further details of *Kingspan Therma*taper™ TT47 LPC/FM are available from Kingspan Insulation (see rear cover) and should be consulted as early as possible in the process of designing a roof.

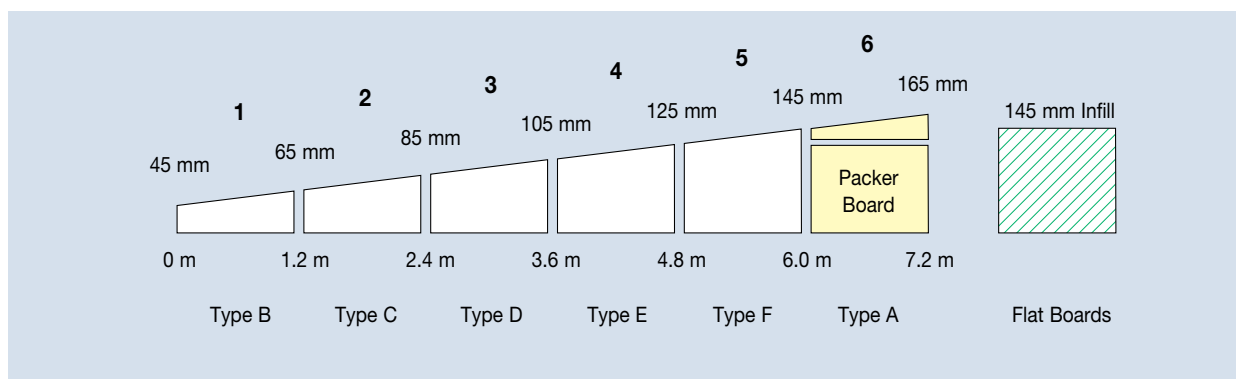


Figure 6

Roof Waterproofing

Kingspan Thermaroof™ TR27 LPC/FM is suitable for use with most fully adhered single-ply waterproofing membranes. When using *Kingspan Thermaroof™* TR27 LPC/FM with fully adhered single-ply waterproofing membranes, the joints between boards and cut edges, immediately below the waterproofing membrane, must be taped with a min. 50 mm wide foil tape. Please contact Kingspan Insulation (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 Thermaroof™ TR27 LPC/FM is also suitable for use with some cold liquid applied waterproofing systems. When using *Kingspan Thermaroof™* TR27 LPC/FM with cold liquid applied waterproofing systems, a carrier membrane for the waterproofing must be installed over the insulation boards. Advice should be sought, from the waterproofing system manufacturer, about the specification of the carrier membrane and the compatibility of the waterproofing system with *Kingspan Thermaroof™* TR27 LPC/FM. For further advice please contact Kingspan Insulation (see rear cover).

NB Kingspan Thermaroof™ TR27 LPC/FM is also suitable for use with mechanically fixed single-ply waterproofing membranes.

Water Vapour Control

Kingspan Thermaroof™ TR27 LPC/FM should be installed over a separate vapour control layer, in new build roofs, unless it is being used in conjunction with a sealed metal deck. Regardless of the deck type it is recommended that a condensation risk analysis is carried out for every project.

For refurbishment projects, involving the addition of insulation to existing insulated flat roofs, or roofs constructed of insulated steel faced composite panels, it is imperative that a U-value calculation and condensation risk analysis is carried out for every project, in order to ensure that the correct thickness of insulation is installed to achieve the required thermal performance, whilst avoiding interstitial condensation.

In refurbishment projects, where *Kingspan Thermaroof™* TR27 LPC/FM is to be installed over an existing bituminous waterproofing membrane, the membrane can be used as a vapour control layer, as long as it is in a good water tight condition. Where this is not the case, a separate vapour control layer should be installed.

The type of separate vapour control layer required will be dependent upon the chosen method of fixing the insulation boards.

For mechanically fixed applications, a minimum vapour control layer should consist of a 1000 gauge (250 micron) polythene sheet, with all joints lapped and then sealed with double sided self adhesive tape.

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 boards and sufficient resistance to wind up-lift (see 'Wind Loading').

Roof Loading / Traffic

Kingspan Thermaroof™ TR27 LPC/FM is suitable for use on access roof decks subject to limited foot traffic.

Where inappropriate foot traffic is liable to occur, it is recommended that, for roofs waterproofed with fully adhered single-ply or cold liquid applied waterproofing systems, the roof surface is protected by specially constructed walk-ways.

For further advice on the acceptability of specific foot traffic regimes, please contact Kingspan Insulation (see rear cover).

Green Roofs

Kingspan Thermaroof™ TR27 LPC/FM 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/m² 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 6399-2: 1997 (Loading for Buildings. Code of practice for wind loads) or BS / I.S. EN 1991-1-4: 2005 (National Annex to Eurocode 1 Actions on structures. General Actions. Wind Actions).

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 mechanically fixed (see Sitework). For further information please contact Kingspan Insulation (see rear cover).

Sitework

Board Size Selection

- If consideration is being given to bonding *Kingspan Thermaroof™* TR27 LPC/FM, either in hot bitumen or with the use of a suitable alternative proprietary adhesive system, it is recommended that 1.2 x 0.6 m boards or 1.2 x 1.2 m boards are used.
- All sizes of board are suitable for mechanical fixing.

Installing over Metal Decks

- Where an FM or LPCB approved construction is required, please refer to 'LPCB & FM Certification' on page 14.
- Metal decks should be clean, dry, without large projections, steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- If using a sealed metal deck there is no requirement for a separate vapour control layer.
- If the metal deck is not sealed, and the insulation boards are to be bonded down, in order to ensure an adequate bond between the metal deck and the vapour control layer, the metal deck should be suitably primed, in accordance with the primer manufacturer's instructions, prior to the application of the hot bitumen, or suitable alternative proprietary adhesive system, used to bond the vapour control layer to the deck.
- If the metal deck is not sealed, and the insulation boards are to be mechanically fixed, the vapour control layer should be loose-laid.
- 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.
- Boards of *Kingspan Thermaroof™* TR27 LPC/FM should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixings').
- Alternatively, the insulation boards should be bonded down by laying into hot bitumen (max. temperature 240°C) mopped or poured over the vapour control layer / sealed metal deck, or with the use of a suitable alternative proprietary adhesive system.

- Insulation boards should always be laid break-bonded, either with their long edges at right angles to the trough openings, or diagonally across the corrugation line, and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated with the same thickness of *Kingspan Thermaroof™* TR27 LPC/FM as the general roof area.
- A 25 mm thick *Kingspan Thermaroof™* TR27 LPC/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 Concrete Decks

- Concrete decks should be clean, dry, without large projections, steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- If the insulation boards are to be bonded down, in order to ensure an adequate bond between the vapour control layer and the concrete deck, the concrete or screeded surface should be suitably primed, in accordance with the primer manufacturer's instructions, prior to the application of the hot bitumen, or suitable alternative proprietary adhesive system, used to bond the vapour control layer to the deck.
- If the insulation boards are to be mechanically fixed, the vapour control layer should be loose-laid.
- 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.
- Boards of *Kingspan Thermaroof™* TR27 LPC/FM should be bonded down by laying into hot bitumen (max. temperature 240°C) mopped or poured over the vapour control layer, or with the use of a suitable alternative proprietary adhesive system.

- Alternatively, the insulation boards should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixings').
- Insulation boards should always be laid break-bonded, either with their long edges at right angles to the edge of, or diagonally across the roof, and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated with the same thickness of *Kingspan Thermaroof™* TR27 LPC/FM as the general roof area.
- A 25 mm thick *Kingspan Thermaroof™* TR27 LPC/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 Existing Flat Roofs

- The existing waterproofing membrane surface should be clean, dry, without large projections, steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- Where the existing waterproofing membrane is not fit for purpose as a vapour control layer, and the new insulation boards are to be bonded down, a separate vapour control layer should be bonded to it with hot bitumen, or suitable alternative proprietary adhesive system. If the insulation boards are to be mechanically fixed, the vapour control layer should be loose-laid.
- 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 new waterproofing membrane.
- Boards of *Kingspan Thermaroof™* TR27 LPC/FM should be bonded down by laying into hot bitumen (max. temperature 240°C) mopped or poured over the vapour control layer, or with the use of a suitable alternative proprietary adhesive system.
- Alternatively, the insulation boards should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixings').
- Insulation boards should always be laid break-bonded, either with their long edges at right angles to the edge of, or diagonally across the roof, and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated with the same thickness of *Kingspan Thermaroof™* TR27 LPC/FM as the general roof area.
- A 25 mm thick *Kingspan Thermaroof™* TR27 LPC/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 Existing Composite Panel Roofs

- If the existing profile provides inadequate support for the insulation boards, the existing roof should be over-boarded, e.g. with plywood, prior to their installation.
- Boards of *Kingspan Thermaroof™* TR27 LPC/FM should be secured to the deck using mechanical fixings. Please refer to Kingspan Insulation (see rear cover) for advice on fixing specification.
- Insulation boards should always be laid break-bonded and with joints lightly butted. There should be no gaps at abutments. If the existing roof has been over-boarded, then insulation boards should be laid with their long edges at right angles to the edge of, or diagonally across the roof. If not, they should be laid either with their long edges at right angles to the trough openings, or diagonally across the corrugation line.
- Roof-light or ventilator kerbs etc. should always be insulated with the same thickness of *Kingspan Thermaroof™* TR27 LPC/FM as the general roof area.
- 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.

Mechanical Fixings

- The number of mechanical fixings required to fix *Kingspan Thermaroof™* TR27 LPC/FM will vary with the geographical location of the building, the local topography, and the height and width of the roof concerned along with the deck type.
- A minimum of 4 fixings are required to secure 1.2 x 0.6 m boards of *Kingspan Thermaroof™* TR27 LPC/FM to the deck.
- A minimum of 5 fixings are required to secure 1.2 x 1.2 m boards of *Kingspan Thermaroof™* TR27 LPC/FM to the deck.
- A minimum of 6 fixings are required to secure 2.4 x 1.2 m boards of *Kingspan Thermaroof™* TR27 LPC/FM to the deck.
- The requirement for additional fixings should be assessed in accordance with BS 6399-2: 1997 (Loadings for buildings. Code of practice for wind loads) or BS / I.S. EN 1991-1.4: 2005 (National Annex to Eurocode 1. Actions on structures, General Actions, Wind Actions).
- Mechanical fixings must be arranged in an even pattern.
- Fasteners at insulation board edges must be located > 50 and < 150 mm from edges and corners of the board and not overlap board joints.
- Please refer to page 12 for recommended fixing patterns.
- Each fixing should incorporate a square or circular plate washer (min. 50 x 50 mm or 50 mm diameter).
- If two layers of insulation are to be installed, the base layer should be mechanically fixed with minimum 1 No. fixing in the centre of the insulation board before fixing the top layer as described above.
- Where alternative mechanical fixing systems are specified, such as bar fixing systems, the specified system must give similar restraint to the insulation board as would be attained by the use of conventional telescopic tube fasteners.

Installing in Two Layers

- In situations where two layers of insulation are required, both layers should be installed in the same manner, as detailed in the preceding sections. However, if mechanical fixing methods are to be employed, refer to 'Mechanical Fixings' for guidance on the number of fixings to be used in each layer.
- In all cases, the layers should be horizontally offset relative to each other so that, as far as possible, the board joints in the two adjacent layers do not coincide with each other (see Figure 6).

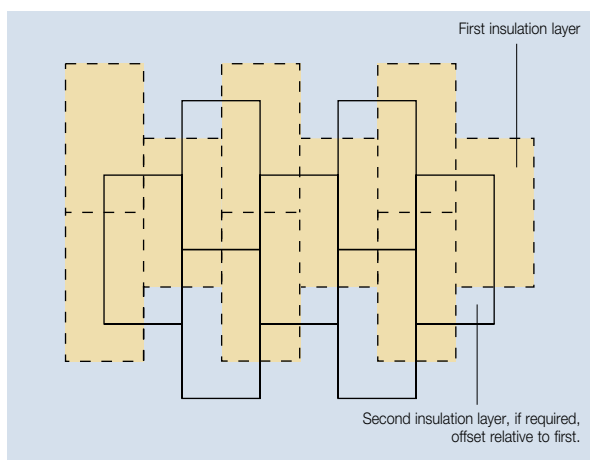


Figure 6 Offsetting of Multiple Insulation Layers

General

Following Trades

- The roof must be adequately protected when building works are being carried out on or over the roof surface. This is best achieved by close boarding. The completed roof must not be used for storage of heavy building components such as bricks or air conditioning equipment.

Reflective Coatings

- Bitumen based built up waterproofing systems laid over *Kingspan Thermo*roof™ TR27 LPC/FM should always incorporate a solar reflective layer such as chippings or a specialist coating.

Daily Working Practice

- At the completion of each day's work, or whenever work is interrupted for extended periods of time, a night joint must be made in order to prevent water penetration into the roof construction.

Cutting

- Cutting 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 to achieve close-butting joints and continuity of insulation.

Availability

- Please contact Kingspan Insulation (see rear cover) to enquire about the availability of *Kingspan Thermo*roof™ TR27 LPC/FM

Packaging and Storage

- The polyethylene packaging of Kingspan Insulation products, which is recyclable, should not be considered adequate for outdoor protection.
- Ideally, boards should be stored inside a building. If, however, outside storage cannot be avoided, then the boards should be stacked clear of the ground and covered with an opaque polythene sheet or weatherproof tarpaulin. Boards that have been allowed to get wet should not be used.

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.com

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

Mechanical Fixing Patterns

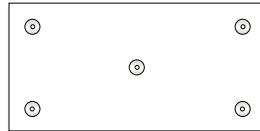
Recommended Fixing Patterns

The recommended fixing patterns for *Kingspan Thermaroof™* TR27 LPC/FM are shown below. The number of fixings necessary should be assessed in accordance with BS 6399-2: 1997 (Loadings for buildings. Code of practice for wind loads) or BS / I.S. EN 1991-1.4: 2005 (National Annex to Eurocode 1. Actions on structures, General Actions, Wind Actions).

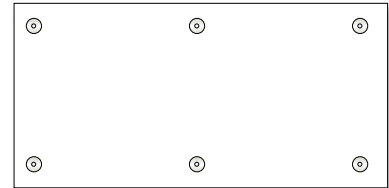
The images below show recommended fixing patterns, the number of fixings used and the resulting fixing density (number of fixings per m²).



4 No. per board
(1.2 x 0.6 m board – 5.55 fixings / m²)

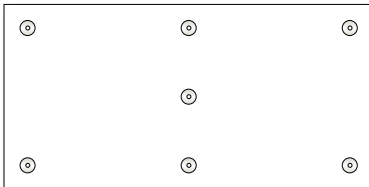


5 No. per board
(1.2 x 0.6 m board – 6.94 fixings / m²)
(1.2 x 1.2 m board – 3.47 fixings / m²)

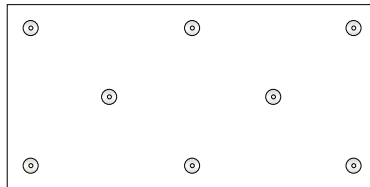


6 No. per board
(1.2 x 0.6 m board – 8.33 fixings / m²)
(1.2 x 1.2 m board – 4.16 fixings / m²)
(2.4 x 1.2 m board – 2.08 fixings / m²)

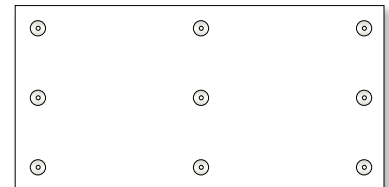
A minimum of 4 fixings are required to secure a 1.2 m x 0.6 m insulation board to the deck, a minimum of 5 fixings are required to secure a 1.2 x 1.2 m insulation board to the deck and a minimum of 6 fixings are required to secure a 2.4 x 1.2 m insulation board to the deck. Therefore, of the two fixing patterns above, that on the left can only be applied for a 1.2 x 0.6 m insulation board and that on the right for a 1.2 x 0.6 m insulation board or a 1.2 x 1.2 m insulation board.



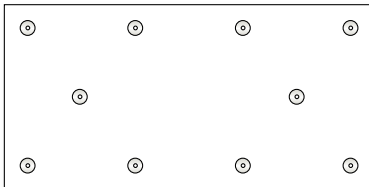
7 No. per board
(1.2 x 0.6 m board – 9.72 fixings / m²)
(1.2 x 1.2 m board – 4.86 fixings / m²)
(2.4 x 1.2 m board – 2.43 fixings / m²)



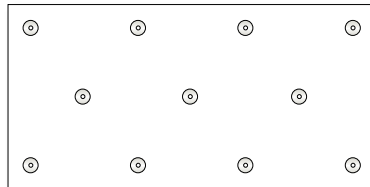
8 No. per board
(1.2 x 0.6 m board – 11.11 fixings / m²)
(1.2 x 1.2 m board – 5.55 fixings / m²)
(2.4 x 1.2 m board – 2.77 fixings / m²)



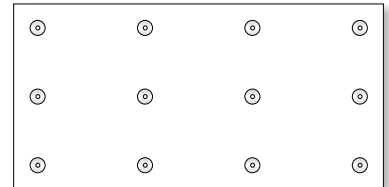
9 No. per board
(1.2 x 0.6 m board – 12.50 fixings / m²)
(1.2 x 1.2 m board – 6.25 fixings / m²)
(2.4 x 1.2 m board – 3.12 fixings / m²)



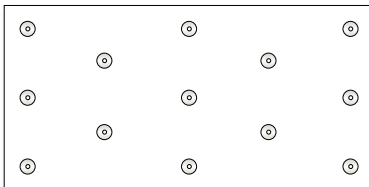
10 No. per board
(1.2 x 0.6 m board – 13.88 fixings / m²)
(1.2 x 1.2 m board – 6.94 fixings / m²)
(2.4 x 1.2 m board – 3.47 fixings / m²)



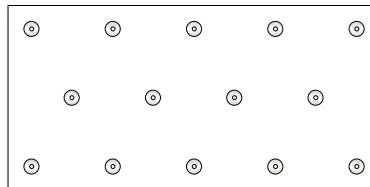
11 No. per board
(1.2 x 0.6 m board – 15.27 fixings / m²)
(1.2 x 1.2 m board – 7.63 fixings / m²)
(2.4 x 1.2 m board – 3.81 fixings / m²)



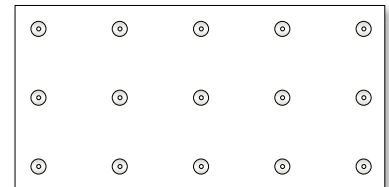
12 No. per board
(1.2 x 0.6 m board – 16.66 fixings / m²)
(1.2 x 1.2 m board – 8.33 fixings / m²)
(2.4 x 1.2 m board – 4.16 fixings / m²)



13 No. per board
(1.2 x 0.6 m board – 18.05 fixings / m²)
(1.2 x 1.2 m board – 9.02 fixings / m²)
(2.4 x 1.2 m board – 4.51 fixings / m²)



14 No. per board
(1.2 x 0.6 m board – 19.44 fixings / m²)
(1.2 x 1.2 m board – 9.72 fixings / m²)
(2.4 x 1.2 m board – 4.86 fixings / m²)



15 No. per board
(1.2 x 0.6 m board – 20.83 fixings / m²)
(1.2 x 1.2 m board – 10.41 fixings / m²)
(2.4 x 1.2 m board – 5.20 fixings / m²)

NB Mechanical fixings e.g. telescopic tube fasteners, must be arranged in an even pattern. Fasteners at board edges must be located > 50 mm and < 150 mm from edges and corners of the board and not overlap board joints.

Product Details

The Facings

Kingspan Thermaroof™ TR27 LPC/FM is faced on both sides with a coated glass tissue, autohesively bonded to the insulation core during manufacture.

The Core

The core of *Kingspan Thermaroof™* TR27 LPC/FM is manufactured with **Ni®** technology, a fibre-free high performance rigid thermoset polyisocyanurate (PIR) insulant manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).



The core of *Kingspan Thermaroof™* TR27 LPC/FM has a 90% (or greater) closed cell structure.

Standards and Approvals

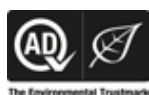
Kingspan Thermaroof™ TR27 LPC/FM is manufactured to the highest standards in accordance with the requirements of both BS 4841-3 (Rigid polyisocyanurate (PIR) and polyurethane (PUR) products for building end-use applications. Specification for laminated boards (roofboards) with auto-adhesively or separately bonded facings for use as roofboard thermal insulation under built-up bituminous roofing membranes) and BS 4841-4 (Rigid polyisocyanurate (PIR) and polyurethane (PUR) products for building end-use applications. Specification for laminated boards (roofboards) with auto-adhesively or separately bonded facings for use as roofboard thermal insulation under single-ply roofing membranes).

Kingspan Thermaroof™ TR27 LPC/FM is also manufactured to the highest standards under a management system certified to ISO 9001: 2008 (Quality management systems. Requirements), ISO 14001: 2004 (Environmental Management Systems. Requirements) and BS / I.S OHSAS 18001: 2007 (Health and Safety Management Systems. Requirements).

Kingspan Thermaroof™ TR27 LPC/FM, produced at Kingspan Insulation's Pembridge and Selby, UK, manufacturing facilities, is covered by BBA Certificate 06/4372.



Kingspan Thermaroof™ TR27 LPC/FM produced at Kingspan Insulation's Pembridge, UK manufacturing facility, is certified by Abu Dhabi Quality and Conformity Council.



Kingspan Thermaroof™ TR27 LPC/FM is approved for use by the State of Qatar Ministry of Interior General Admin of Civil Defence.

Density

The apparent density of *Kingspan Thermaroof™* TR27 LPC/FM is 32 kg/m³ when tested to BS EN 1602: 2013 (thermal insulating products for building application. Determination of the apparent density).

Standard Dimensions

Kingspan Thermaroof™ TR27 LPC/FM is available in the following standard size(s):

Nominal Dimension		Availability		
Length	(m)	1.2*	1.2	2.4
Width	(m)	0.6*	1.2	1.2
Insulant Thickness	(mm)	Refer to local distributor or Kingspan Insulation for current stock and non-stock sizes.		

Table 5: Standard Dimensions of *Kingspan Thermaroof™* TR27 LPC/FM

* for product produced at Kingspan Insulation's British manufacturing facilities only.

Compressive Strength

The compressive strength of *Kingspan Thermaroof™* TR27 LPC/FM typically exceeds 150 kPa at 10% compression, when tested to BS / I.S. EN 826: 1996 (Thermal insulating products for building applications. Determination of compression behaviour).

Water Vapour Resistivity

The product typically achieves a resistivity greater than 300 MN·s/g·m, when tested in accordance with BS EN 12086: 1997 / I.S. EN 12086: 1998 (Thermal insulating products for building applications. Determination of water vapour transmission properties). *Kingspan Thermaroof™* TR27 LPC/FM should always be installed over a vapour control layer or sealed metal deck (see 'Water Vapour Control' on page 7).

Durability

If correctly installed, *Kingspan Thermaroof™* TR27 LPC/FM can have an indefinite life. Its durability depends on the supporting structure and the conditions of its use.

Resistance to Solvents, Fungi & Rodents

The insulation core is resistant to short-term contact with petrol and with most dilute acids, alkalis and mineral oils. However, it is recommended that any spills be cleaned off fully before the boards are installed. Ensure that safe methods of cleaning are used, as recommended by the suppliers of the spilt liquid. The insulation core is not resistant to some solvent-based adhesive systems, particularly those containing methyl ethyl ketone. Adhesives containing such solvents should not be used in association with this product.

Damaged boards or boards that have been in contact with harsh solvents or acids should not be used.

The insulation core and facings used in the manufacture of *Kingspan Thermaroof™* TR27 LPC/FM resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire Performance

Kingspan Thermaroof™ TR27 LPC/FM, when subjected to the British Standard fire test, specified in the table below, will achieve the result shown, when waterproofed with a single-ply waterproofing membrane.

Test	Result
BS 476-3: 2004 (External fire exposure roof test)	Dependent on single-ply membrane adopted

Table 6: BS 476-3 result of *Kingspan Thermaroof™* TR27 LPC/FM.

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

LPCB & FM Certification

FM Certification

Kingspan Thermaroof™ TR27 LPC/FM is certified as achieving Class 1 Insulated Steel Deck Pass to Factory Mutual Research Standards 4450: 1989 (Approval Standard for Class 1 Insulated Steel Deck Pass) and 4470: 2010 (Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 Non-combustible Roof Deck Construction), subject to the conditions of approval as a roof insulation product for use in Class 1 roof constructions as described in the current edition of the Factory Mutual Research Approval Guide.



LPCB Certification

Metal deck roofing constructions incorporating *Kingspan Thermaroof™* TR27 LPC/FM, produced at Kingspan Insulation's Pembridge and Castleblayney, UK and Ireland, manufacturing facilities, have been successfully tested to LPS 1181: Part 1 (Requirements and Tests for Built-up Cladding and Sandwich Panel Systems for use as the External Envelope of Buildings). The table below indicates the LPCB listed approvals for *Kingspan Thermaroof™* TR27 LPC/FM.

For further details please contact Kingspan Insulation (see rear cover) or alternatively search for **Thermaroof™** TR27 LPC/FM" or approval reference number 388b/02 on

www.redbooklive.com.

Product	Thickness (mm)	Vapour Control	Grade	LPCB Ref No.
<i>Kingspan Thermaroof™</i> TR27 LPC/FM	30 – 120 in a single layer	Sealed metal deck or separate vapour control layer	EXT – B	388b/02

Table 7: LPS 1181: Part 1 result of *Kingspan Thermaroof™* TR27 LPC/FM



LPS 1181: Part 1
Certificate No.
388b/02

Thermal Properties

The λ -values and R-values detailed below are quoted in accordance with ASTM C 518.

Thermal Conductivity

The boards achieve a thermal conductivity (λ -value) of 0.022 W/m·K at 23°C mean temperature.

Thermal Resistance

Thermal resistance can be expressed in either metric or imperial measurement. Using the imperial measurement, the boards achieve a thermal resistance (R-value) per inch of thickness is 6.55 ft²·hr·°f/Btu.

The metric measurement of thermal resistance Thermal resistance (R-value) varies with thickness and is calculated by dividing the thickness of the board (expressed in metres) by its thermal conductivity. The resulting number is rounded down to the nearest 0.05 (m²·K/W).

Insulant Thickness (mm)	Thermal Resistance (m ² ·K/W)
50	2.25
60	2.70
70	3.15
75	3.40
80	3.60
85	3.85
90	4.05
95	4.30
100	4.50
110	5.00
120	5.45
125	5.65
130	5.90
140	6.35
150	6.80
160	7.25

Table 8: Thermal Resistance of Differing Thicknesses of *Kingspan Thermaroof™* TR27 LPC/FM

NB Refer to local distributor or Kingspan Insulation price list for current stock and non-stock sizes.

Kingspan Insulation reserves the right to amend product specifications without prior notice. The information contained in the document is given in good faith and applies to the uses described. Recommendations for use should be verified as to the suitability and compliance with actual requirements, specifications and any applicable laws and regulations. Kingspan Insulation recommend using the Technical Advice service.



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Countries comprise: the Middle East as far North and East as (and including) Turkey, Iran and Oman and as far South and West as (and including) Saudi Arabia and Yemen

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