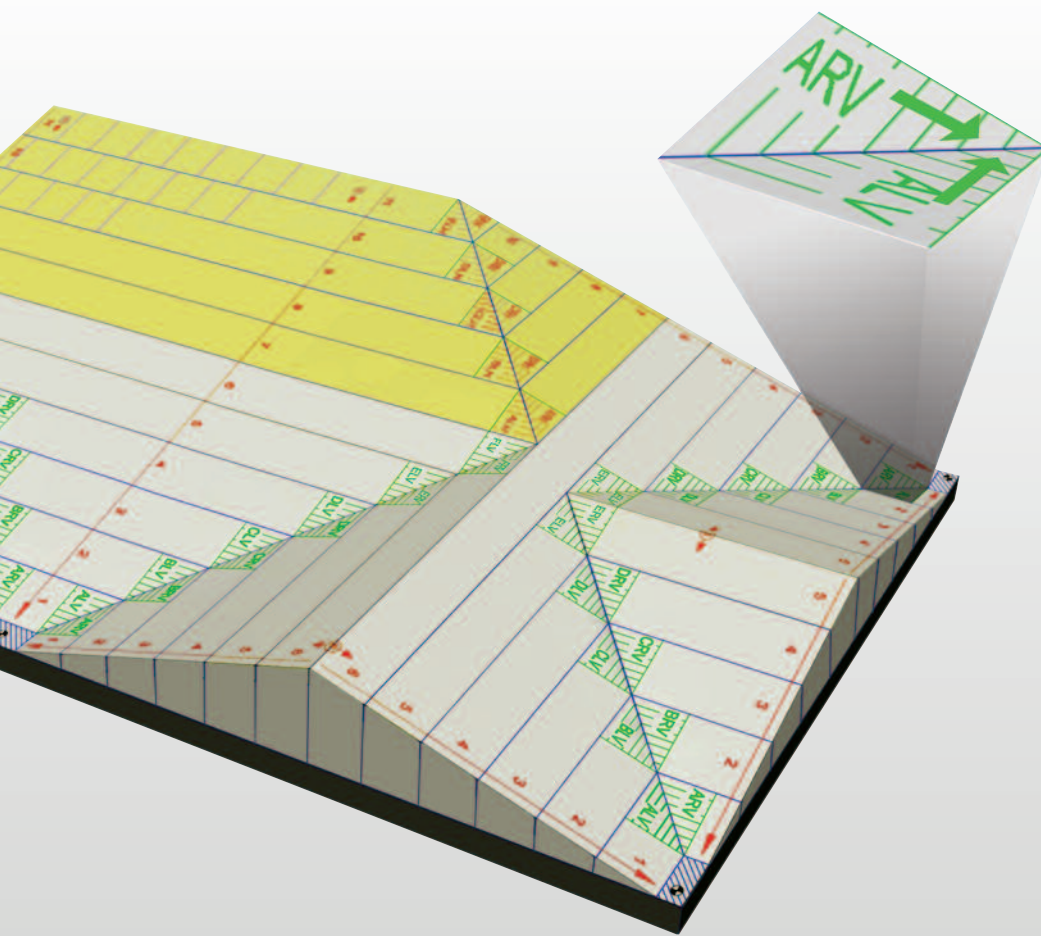




Thermataper® LPC/FM Systems

TAPERED INSULATION TO ENHANCE WATER DRAINAGE FROM FLAT ROOFS



- 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
- Insulation and drainage in one
- Compatible with most waterproofing and green roof systems
- Provides a practical alternative to screeding, structural falls or firrings
- Load bearing implications for an existing structure can be minimal
- 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
- Tapered insulation U-values calculated according to Annex C of BS EN ISO 6946: 2007



LPS 1181: Part 1
Certificate No. 388b



APPROVED
Class 1 Roof
Construction



Low Energy –
Low Carbon Buildings

Introduction to **Thermataper**® LPC/FM Systems

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: **Thermataper**® LPC/FM from Kingspan Insulation Limited.

Many flat roof failures can be traced to the inability of the roof to shed rainwater from its surface, leading to the formation of water ponds. Ponding of rainwater can decrease the design life of a roof by subjecting its waterproofing membrane to attack from thermal stress and growth of plants, moss and algae.

Excessive ponding can also increase roof loading, causing further deflection of the deck, which may add to the problem of drainage. The most effective solution is to eliminate ponding by designing an adequate fall into the roof.

The Solution

Kingspan Thermataper® LPC/FM Systems have been developed to help solve these problems. *Kingspan Thermataper*® LPC/FM Systems comprise tapered insulation boards, flat packer boards, pre-mitred hip and valley boards and the market's leading tapered roofing design service. *Kingspan Thermataper*® 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 Thermataper*® LPC/FM System eliminates the need to incorporate a fall into the design of the roof deck. On existing roofs, a *Kingspan Thermataper*® LPC/FM System 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 waterproofing must be sound, in order to provide a satisfactory surface for the *Kingspan Thermataper*® LPC/FM System, and the risk of interstitial condensation must be fully assessed.

Cheaper

Using a *Kingspan Thermataper*® 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. timber firrings or screed) to create a fall in a flat roof for rainwater drainage purposes.

Quicker

Kingspan Thermataper® LPC/FM Systems avoid a wet trade and do not need time to dry out, saving time in the scheduling of a construction project. It has been estimated that screed to falls systems may require up to 195 days, or more, to dry.

Lighter

Kingspan Thermataper® 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 Thermataper*® 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.

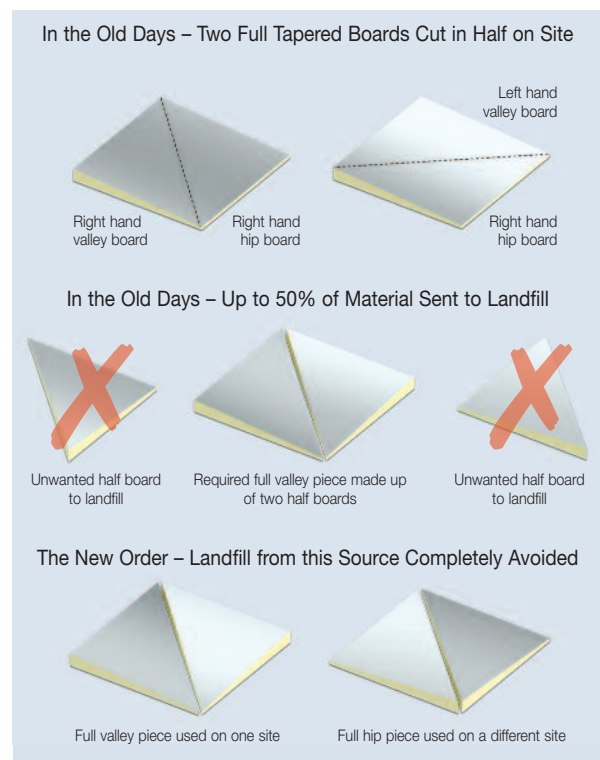
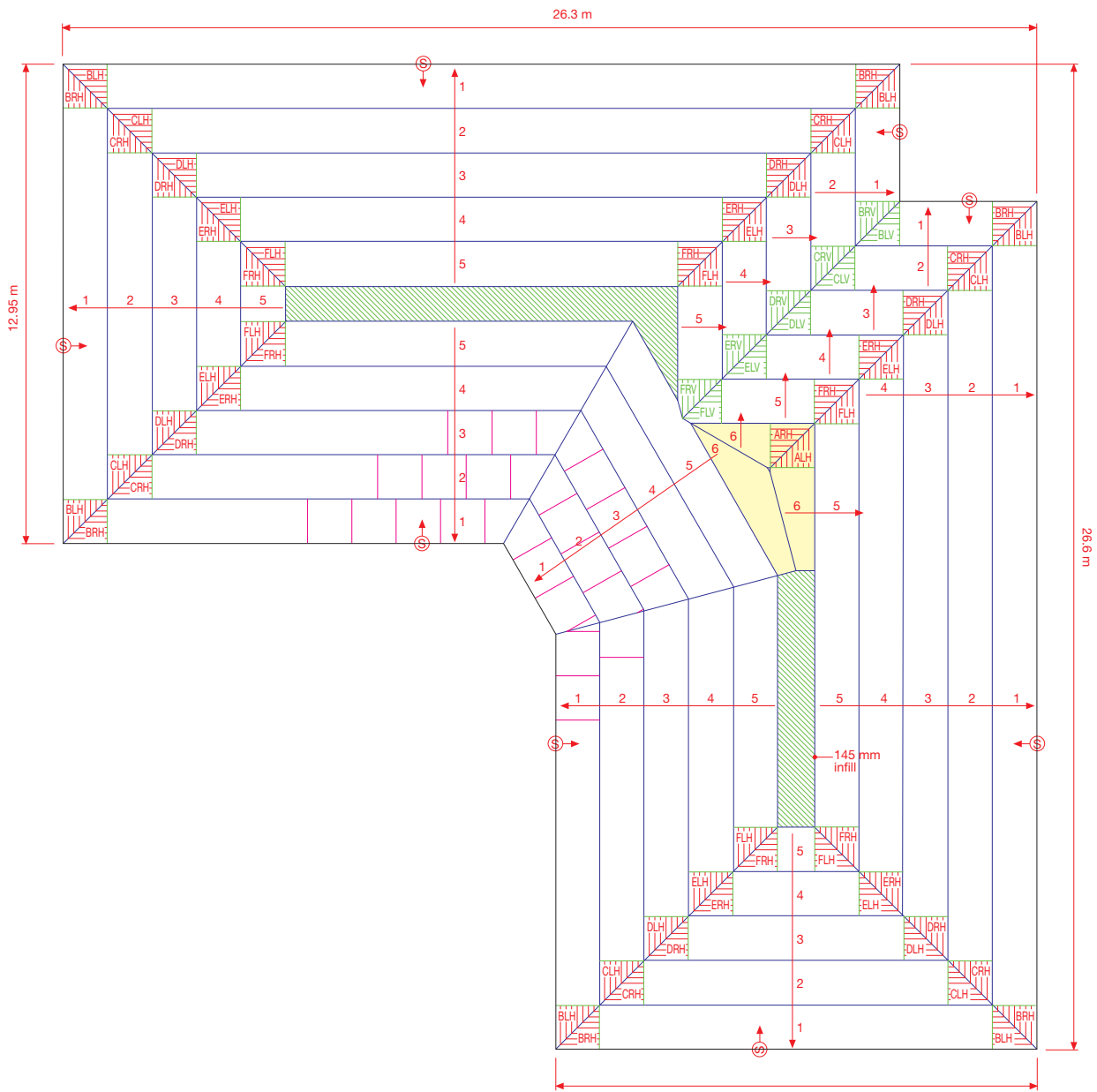


Figure 1 How Kingspan Pre-Mitred Tapered Flat Roof Insulation Boards Save Waste from Going to Landfill

Typical Tapered Roofing Design for *Kingspan Thermataper*® TT47 LPC/FM



Section 1:60

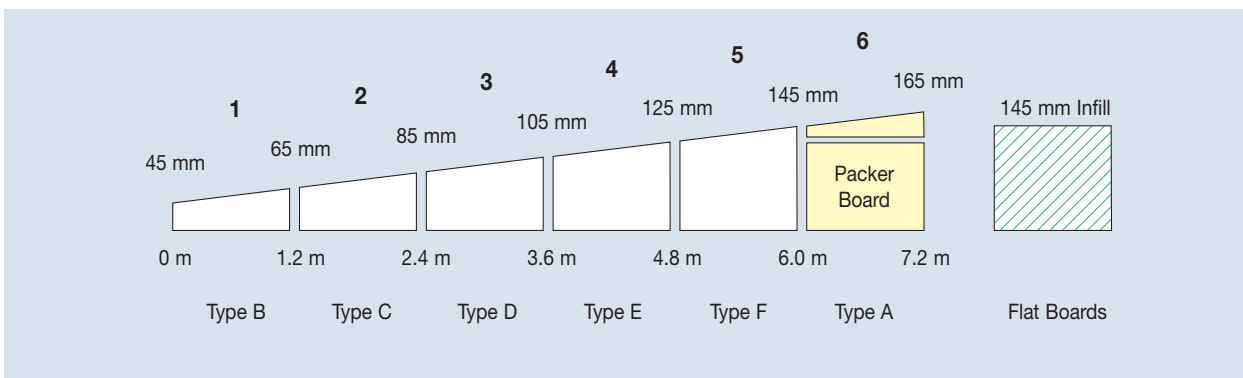


Figure 2

Thermataper® LPC/FM System Design Considerations

Design Services

Efficiency by Design

Kingspan Thermataper® 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.

Board Layout & Falls Design

The design of the board layout and falls of a successful *Kingspan Thermataper*® LPC/FM System must take several factors into account:

- the position of the roof outlets;
- the extent of water run-off required;
- the dimensions of the roof;
- the presence of any existing falls or steps on the roof; and
- the location and dimensions of permanent projections such as roof lights, vents etc., and perimeter restrictions.

Normally, for new roofs, this information can be most simply acquired from an architect's drawing. It is strongly recommended that architect's drawings are submitted electronically by email but they can be supplied in any of the following ways:

- electronically by email;
- electronically on a CD, DVD or memory stick by post; or
- as a hard copy drawing by post.

For email and postal addresses, see rear cover.

On existing British roofs, a free survey of the roof will be carried out by one of our experienced surveyors to collect the required information.

The board layout and falls of even the most complex tapered system can be designed quickly and effectively, ready for client approval. The design will illustrate the required direction of drainage and will also take into account U-value requirements, condensation risk and minimum / maximum rise restrictions. Client amendments or revisions can be easily incorporated. Wind uplift and corresponding restraint requirements for insulation boards can be calculated if necessary. This service operates under a quality control system certified to BS EN ISO 9001: 2008 (Quality management systems. Requirements) in Britain.

Once the final design has been accepted by the client and the *Kingspan Thermataper*® LPC/FM System is ordered, a working drawing will be produced on waterproof paper. This drawing will clearly set out the fall pitch, fall direction and fixing of each board type, and will clearly match the markings on the boards. Installation of *Kingspan Thermataper*® LPC/FM Systems is simple using these easy to follow drawings and, to facilitate installation, each board type is packed separately in labelled shrink wrapped packs.

Condensation Risk Analysis

Included in the design service is the calculation of condensation risk in accordance with BS 5250: 2002 (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 Thermataper*® LPC/FM System, whilst also ensuring any condensation risk is within the limits given in BS 5250: 2002.

Calculation of U-values

U-values for *Kingspan Thermataper*®

LPC/FM Systems are calculated, under a

management system certified to the BBA

Scheme for Assessing the Competency of

Persons to Undertake U-value and Condensation Risk

Calculations, in accordance with Annex C of BS EN ISO 6946:

2007 (Building components and building elements – Thermal resistance and thermal transmittance – Calculation method). Annex C outlines the calculation procedure to determine the total thermal transmittance of tapered insulation – termed the 'Annex C U-value'.



Typical U-values

Kingspan Thermataper® LPC/FM Systems can easily meet the U-values required for compliance with Building Regulations / Standards. A detailed U-value calculation together with condensation risk analysis should be completed for each individual project. Please contact the Kingspan Insulation Tapered Roofing Department (see rear cover) for assistance.

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 always insulated with the same thickness of *Kingspan Thermataper*® TT46 LPC/FM or *Kingspan Thermataper*® TT47 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 as high as the flat roof insulation upstand. Please contact the Kingspan Insulation Technical Service Department (see rear cover) for further advice.

Environmental Impact & Responsible Sourcing

Green Guide Rating

Ecoprofiles, certified by BRE Certification to the 2008 BRE Environmental Profiles Methodology, have been created for *Kingspan Thermaaper*® TT46 LPC/FM and *Kingspan Thermaaper*® TT47 LPC/FM produced at Kingspan Insulation's British manufacturing facilities. The BRE has assigned the products a 2008 Green Guide Summary Rating of A+ and A respectively.



Environmental Profiles Scheme
Certificate Number ENP 409

Responsible Sourcing

Kingspan Thermaaper® TT46 LPC/FM and *Kingspan Thermaaper*® TT47 LPC/FM are manufactured under a management system certified to BS / I.S. EN ISO 14001: 2004. The principle polymer components of the products are also manufactured under management systems certified to EN ISO 14001: 2004.

NB The above information is correct at the time of writing. Please confirm at the point of need by contacting Kingspan Insulation's Technical Service Department (see rear cover), from which copies of Kingspan Insulation and its suppliers' ISO 14001 certificates can be obtained along with confirmation of Kingspan Insulation's products' Green Guide ratings.

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 British operations is available at www.kingspaninsulation.co.uk/sustainabilityandresponsibility.

Wind Loading

Wind loadings 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) 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.

Spanning on Metal Decks

The designer's attention is drawn to the requirement that insulation boards are of the minimum thicknesses shown in the table below, when used over metal decks with trough openings as shown.

Trough Opening (mm)	Minimum Insulant Thickness (mm)
≤ 75	25
76-100	30
101-125	35
126-150	40
151-175	45
176-200	50
201-225	55
225-250	60

Green Roofs

Kingspan Thermaaper® TT46 LPC/FM and *Kingspan Thermaaper*® TT47 LPC/FM are 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 the Kingspan Insulation Technical Service Department (see rear cover).

Lightning Protection

Building designers should give consideration to the requirements of BS / I.S. EN 62305: 2006 (Protection against lightning).

Thermataper® LPC/FM Systems

Project Gallery



Project: Century Wharf
Location: Cardiff Bay
Use: Apartments
Specifier: White Young Green
Product: *Kingspan* **Thermataper®**
TT46 LPC/FM

Project: Walthamstow Academy
Location: London
Use: Education
Specifier: Howarth Litchfield Partnership
Product: *Kingspan* **Thermataper®**
TT46 LPC/FM



Project: St Mary's Garden Hall
Location: London
Use: Community Centre
Specifier: White Young Green
Product: *Kingspan* **Thermaiaper**[®]
TT47 LPC/FM



Project: RSPB Building
Location: Rainham Marshes, Essex
Use: Environment &
Education Centre
Specifier: Heyningen and Haward
Product: *Kingspan* **Thermaiaper**[®]
TT47 LPC/FM



Thermataper® TT46 LPC/FM Design Considerations

Typical Constructions

Metal Deck

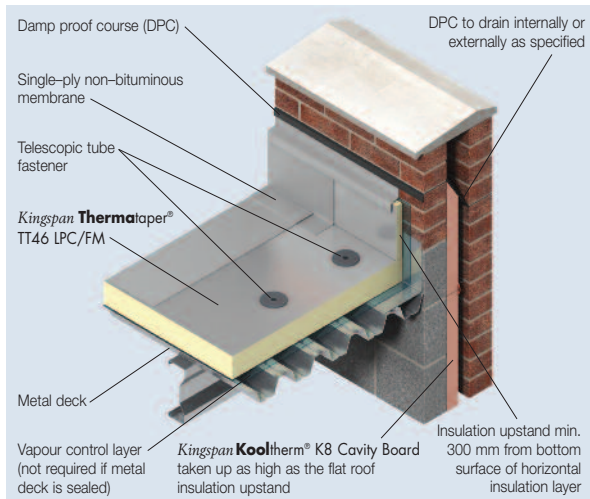


Figure 3

Dense Concrete Deck

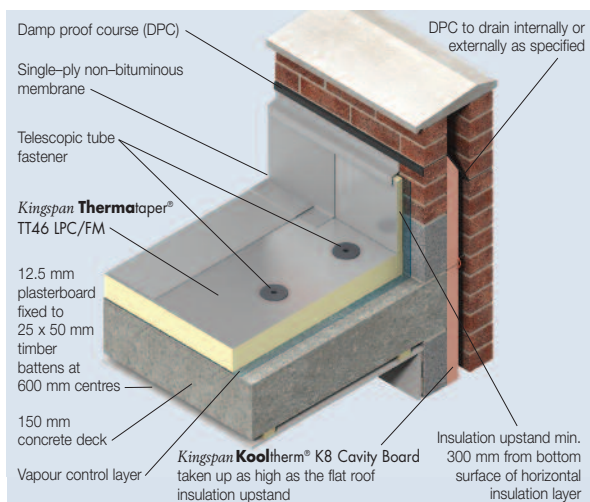


Figure 4

Specification Clause

Kingspan Thermataper® TT46 LPC/FM should be described in specifications as:-

The roof insulation shall be Kingspan Thermataper® TT46 LPC/FM ___mm thick: comprising a high performance rigid thermoset insulation core faced on both sides with a low emissivity composite foil 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 4841-4; under a management system certified to BS / I.S. EN ISO 9001: 2008, BS / I.S. EN ISO 14001: 2004 and BS / I.S. OHSAS 18001: 2007; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

All U-values shall be calculated in accordance with Annex C of BS EN ISO 6946: 2007 (Building components and building elements – Thermal resistance and thermal transmittance – Calculation method).

NBS Specifications

Details also available in NBS Plus.
NBS users should refer to clause(s):
J42 420, J42 430
(Standard and Intermediate)
J42 10 (Minor Works)



Roof Waterproofing

Kingspan Thermataper® TT46 LPC/FM is suitable for use with most mechanically fixed single-ply waterproofing membranes.

Please note: Kingspan Thermataper® TT46 LPC/FM is not suitable for use with bitumen based built-up waterproofing systems or mastic asphalt.

Water Vapour Control

Kingspan Thermataper® TT46 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, 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 Thermataper® TT46 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.

A minimum separate 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.

Roof Loading / Traffic

Kingspan Thermataper® TT46 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 the roof surface is protected by specially constructed walk-ways.

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

Thermataper® TT46 LPC/FM Sitework

Laying pattern

- The working drawings supplied by the Kingspan Insulation Tapered Roofing Department will indicate the area of the roof to be covered, the minimum insulation level, fall direction and pitch of the tapered system.
- The location of each board type will be indicated clearly on the drawing and each pack will contain one board type only.
- Ridges, hips and valleys will be marked on the drawings, together with the setting out commencement points for laying of the boards.
- In situations where two or more layers of insulation are required, all layers should be installed in the same manner, as detailed in the following sections. However, 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 any two adjacent layers do not coincide with each other (see Figures 5 and 6).

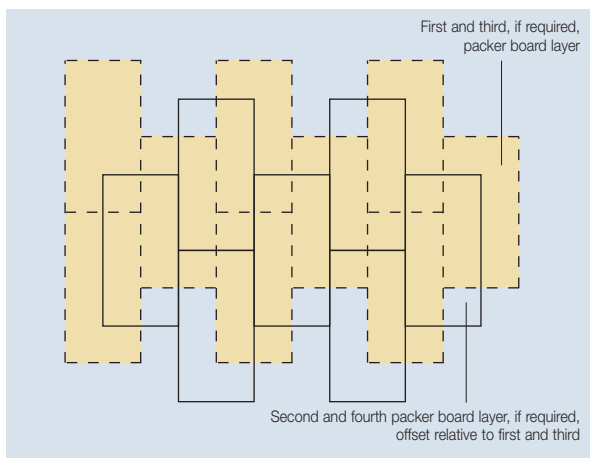


Figure 5 Offsetting of Multiple Packer Board Layers

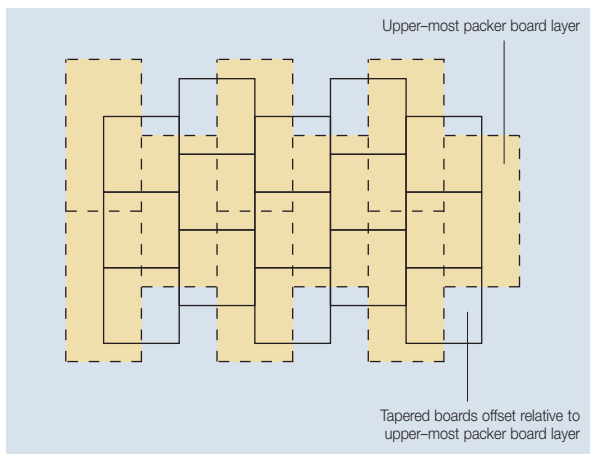


Figure 6 Offsetting of Tapered Boards Relative to Packer Boards

Installing over Metal Decks

- Where an FM or LPCB approved construction is required, please refer to 'LPCB & FM Certification' on page 13.
- Metal decks should be level, clean, dry, and without large projections, steps or gaps.
- If using a sealed metal deck there is no requirement for a separate vapour control layer.
- If the metal deck is not sealed 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 Thermataper® TT46 LPC/FM* should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixing').
- Insulation boards should, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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 also mechanically fixed 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.

Thermataper® TT46 LPC/FM Sitework

Installing over Concrete Decks

- Concrete decks should be level, clean, dry, and without large projections, steps or gaps.
- The vapour control layer should be loose-laid over 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.
- Boards of **Kingspan Thermataper® TT46 LPC/FM** should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixing').
- Insulation boards should, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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 also mechanically fixed 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

- Timber decks should be level, clean, dry, and without large projections, steps or gaps.
- The vapour control layer should be temporarily stapled or nailed 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.
- Boards of **Kingspan Thermataper® TT46 LPC/FM** should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixing').
- Insulation boards should, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Joints between insulation boards should not coincide with those between the plywood sheets.

- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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 also mechanically fixed 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, a separate vapour control layer should be loose-laid over it.
- 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 Thermataper® TT46 LPC/FM** should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixing').
- Insulation boards should, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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.

Mechanical Fixings

- The number of mechanical fixings required to fix *Kingspan Thermataper*® TT46 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 boards of *Kingspan Thermataper*® TT46 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 mm and < 150 mm from edges and corners of the board and not overlap board joints.
- Please refer to page 22 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 or more layers of insulation are to be installed, the packer boards should be mechanically fixed with minimum 1 No. fixing in the centre of the 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.

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.

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

- *Kingspan Thermataper*® TT46 LPC/FM is available through specialist insulation distributors and selected roofing merchants throughout the UK and Ireland.

Packaging and Storage

- The polyethylene packaging of Kingspan Insulation products, which is recyclable, should not be considered adequate for outside protection.
- Ideally boards should be stored inside a building. If however, outside storage cannot be avoided 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 & Safety

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

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 board 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.

Warning – do not stand on or otherwise support your weight on any of these products unless it is fully supported by a load bearing surface.

Thermataper® TT46 LPC/FM Product Details

Product Description

Kingspan **Thermataper**® TT46 LPC/FM is the tapered version of Kingspan **Thermaroof**® TR26 LPC/FM.

The Facings

Kingspan **Thermataper**® TT46 LPC/FM is faced on both sides with a low emissivity composite foil, autohesively bonded to the insulation core during manufacture.

The Core

The core of Kingspan **Thermataper**® TT46 LPC/FM is manufactured with

Nilflam® technology, a 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).



Standards and Approvals

Kingspan **Thermataper**® TT46 LPC/FM is manufactured to the highest standards in accordance with requirements 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 **Thermataper**® TT46 LPC/FM is also manufactured to the highest standards under a management system certified to BS / I.S. EN ISO 9001: 2008 (Quality management systems. Requirements), BS / I.S. EN ISO 14001: 2004 (Environmental Management Systems. Requirements) and BS / I.S. OHSAS 18001: 2007 (Health and Safety Management Systems. Requirements).

Standard Dimensions

Kingspan **Thermataper**® TT46 LPC/FM is available in the following standard size:

Nominal Dimension		Availability
Length	(m)	1.2
Width	(m)	1.2
Insulant Thickness	(mm)	
Systems with a 1:30 & 1:40 fall		50 minimum
Systems with a 1:60 & 1:80 fall		25 minimum
All systems		Unlimited maximum*

* Packer boards will be required above a specific thickness.

Taper Gradients

Kingspan **Thermataper**® TT46 LPC/FM is available ex-stock in falls of 1:30, 1:40, 1:60 and 1:80. For information regarding tapered roof designs incorporating Kingspan **Thermataper**® TT46 LPC/FM in a wider range of falls please contact the Kingspan Insulation Tapered Roofing Department (see rear cover).

Compressive Strength

The compressive strength of Kingspan **Thermataper**® TT46 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 Resistance

Adjusted for the effect of board joints, the product achieves a resistance far greater than 100 MN-s/g, 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 **Thermataper**® TT46 LPC/FM should be installed over a vapour control layer or sealed metal deck (see 'Water Vapour Control' on page 8).

Durability

If correctly installed, Kingspan **Thermataper**® TT46 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 Thermaaper*® TT46 LPC/FM, resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire Performance

Kingspan Thermaaper® TT46 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

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

Thermal Properties

The effective thermal conductivity and thermal resistance of the insulation in a tapered roofing system is specific to the individual roof design. The Kingspan Insulation Tapered Roofing Department (see rear cover for details) performs calculations to determine these values in accordance with Annex C of BS EN ISO 6946: 2007 (Building components and building elements – Thermal resistance and thermal transmittance – Calculation method) as part of the scheme design process.

LPCB & FM Certification

FM Certification

Kingspan Thermaaper® TT46 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 Noncombustible 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 Thermaaper*® TT46 LPC/FM, produced at Kingspan Insulation's Pembridge and Castleblayney 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 Thermaaper*® TT46 LPC/FM.

For further details please contact the Kingspan Insulation Technical Service Department (see rear cover) or alternatively search for "*Thermaaper*® TT46 LPC/FM" or approval reference number 388b/01 on www.redbooklive.com.

Product	Thickness (mm)	Vapour Control	Grade	LPCB Ref No.
<i>Kingspan Thermaaper</i> ® TT46 LPC/FM	30 – 120 in a single layer	sealed metal deck or separate vapour control layer	EXT – B	388b/01



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

Thermataper® TT47 LPC/FM Design Considerations

Typical Constructions

Metal Deck

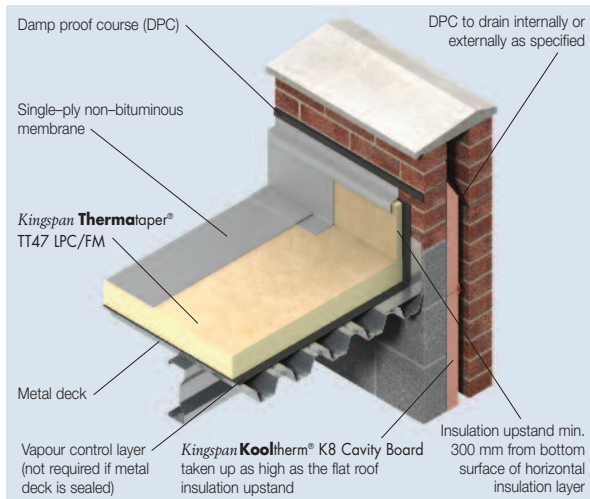


Figure 7

Dense Concrete Deck

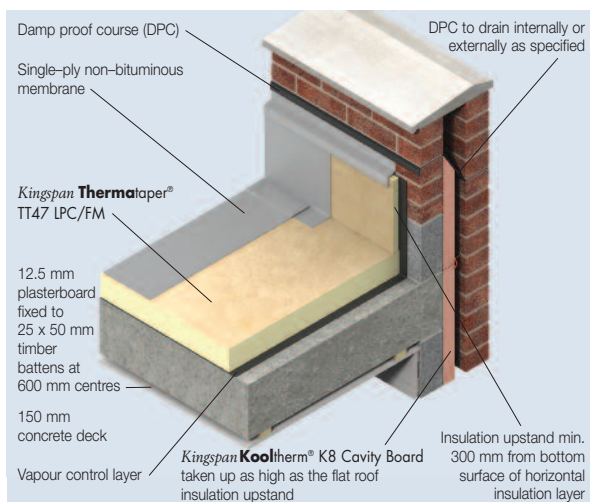


Figure 8

Specification Clause

Kingspan Thermataper® TT47 LPC/FM should be described in specifications as:-

The roof insulation shall be *Kingspan Thermataper*® TT47 LPC/FM ____mm thick: comprising a 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 BS / I.S. EN ISO 9001: 2008, BS / I.S. EN ISO 14001: 2004 and BS / I.S. OHSAS 18001: 2007; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

All U-values shall be calculated in accordance with Annex C of BS EN ISO 6946: 2007 (Building components and building elements – Thermal resistance and thermal transmittance – Calculation method).

NBS Specifications

Details also available in NBS Plus.
NBS users should refer to clause(s):
J21 333, J42 420 and J42 430
(Standard and Intermediate)
J42 10 (Minor Works)



Roof Waterproofing

Kingspan Thermataper® TT47 LPC/FM is suitable for use with most fully adhered single-ply waterproofing membranes. When using *Kingspan Thermataper*® TT47 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 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 Thermataper® TT47 LPC/FM is also suitable for use with most bitumen based waterproofing systems including high performance types which incorporate a Type 3G perforated base layer to BS 747: 2000 (Reinforced bitumen sheets for roofing. Specification). The 3G felt layer should be laid dry and loose, mineral face down with a fully bonded perimeter zone. Partially bonded built-up felt waterproofing should be laid, where applicable, in accordance with BS 8217: 2005 (Reinforced bitumen membranes for roofing. Code of practice).

Kingspan Thermataper® TT47 LPC/FM is also suitable for use with mastic asphalt waterproofing systems. Mastic asphalt waterproofing should be laid, where applicable, in accordance with BS 8218: 1998 (Code of practice for mastic asphalt roofing). Mastic asphalt should always be laid over an isolating layer of loose-laid Type 4A sheathing felt to BS 747: 2000 (Reinforced bitumen sheets for roofing. Specification). The exposed face of insulation upstands, at parapets and abutments, must be lined with 18 mm exterior grade plywood, prior to the mastic asphalt waterproofing being laid. The plywood is used as an anchor point for the expanded metal substrate onto which the vertical mastic asphalt is laid.

When *Kingspan Thermaaper*[®] TT47 LPC/FM is to be used to insulate balconies, waterproofed with mastic asphalt with a porous promenade tile overlay, a 20 mm cork roofboard should be bitumen bonded to the *Kingspan Thermaaper*[®] TT47 LPC/FM prior to laying the Type 4A sheathing felt and mastic asphalt.

Kingspan Thermaaper[®] TT47 LPC/FM is also suitable for use with some cold liquid applied waterproofing systems. When using *Kingspan Thermaaper*[®] TT47 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 Thermaaper*[®] TT47 LPC/FM. For further advice please contact the Kingspan Insulation Technical Service Department (see rear cover).

NB *Kingspan Thermaaper*[®] TT47 LPC/FM is also suitable for use with mechanically fixed single-ply waterproofing membranes.

Water Vapour Control

Kingspan Thermaaper[®] TT47 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, 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 Thermaaper*[®] TT47 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.

For applications where the insulation boards are to be bonded to the vapour control layer, a minimum vapour control layer should consist of a coated roofing felt complying with Type 3B to BS 747: 2000 (Reinforced bitumen sheets for Roofing. Specification), or S1P1 to BS 8747: 2007 (Reinforced bitumen membranes (RBMs) for roofing. Guide to selection and specification), or any appropriate metal-cored vapour control layer.

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 Thermaaper[®] TT47 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 mastic asphalt, a 20 mm cork roofboard is bitumen bonded to the *Kingspan Thermaaper*[®] TT47 LPC/FM prior to waterproofing, and the roof surface is protected by promenade tiles.

Where inappropriate foot traffic is liable to occur, it is recommended that, for roofs waterproofed with partially bonded built-up felt, the roof surface is protected by promenade tiles.

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 the Kingspan Insulation Technical Service Department (see rear cover).

Thermataper® TT47 LPC/FM Sitework

Laying Pattern

- The working drawings supplied by the Kingspan Insulation Tapered Roofing Department will indicate the area of the roof to be covered, the minimum insulation level, fall direction and pitch of the tapered system.
- The location of each board type will be indicated clearly on the drawing and each pack will contain one board type only.
- Ridges, hips and valleys will be marked on the drawings, together with the setting out commencement points for laying of the boards
- In situations where two or more layers of insulation are required, all layers should be installed in the same manner, as detailed in the following sections. However, 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 any two adjacent layers do not coincide with each other (see Figures 9 and 10).

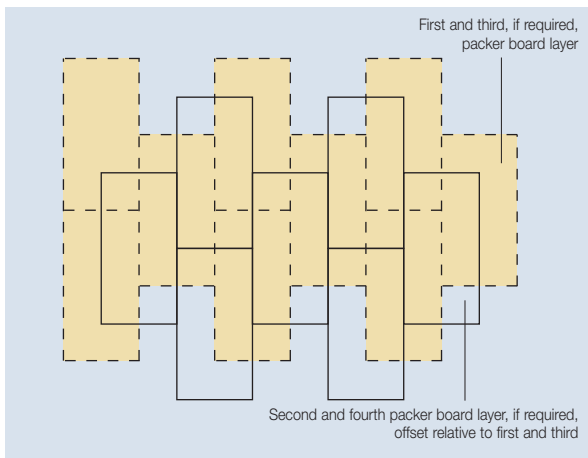


Figure 9 Offsetting of Multiple Packer Board Layers

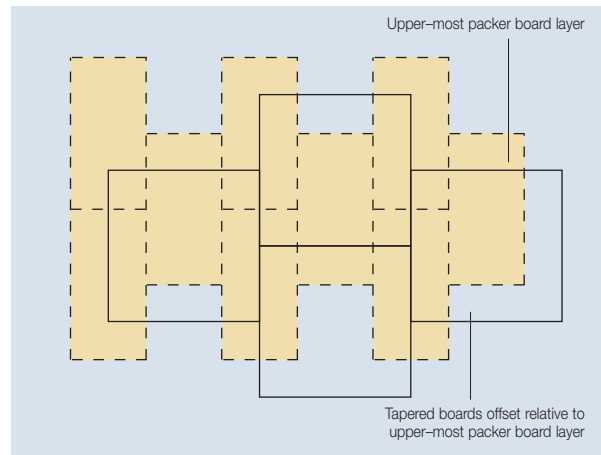


Figure 10 Offsetting of Tapered Boards Relative to Packer Boards

Packer Board Size Selection

- If consideration is being given to bonding *Kingspan Thermo*roof® TR27 LPC/FM packer boards, 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 (in Britain) or 1.2 x 1.2 m boards (in Ireland) 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 21.
- Metal decks should be clean, level, dry, and without large projections, steps or gaps.
- 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 Thermataper*® TT47 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, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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.
- 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, level, dry, and without large projections, steps or gaps.
- 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.
- 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 Thermataper*® TT47 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, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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.
- 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.

Thermataper® TT47 LPC/FM Sitework

Installing over Plywood Decks

- Plywood decks should be clean, level, dry, and without large projections, steps or gaps.
- If the insulation boards are to be bonded down, in order to ensure an adequate bond between the plywood deck and the vapour control layer, the plywood 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.
- Alternatively, the vapour control layer can be nailed to the deck, in which case the nail heads will become sealed with the subsequent bonding of the insulation boards to the vapour control layer.
- 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 Thermataper® TT47 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, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Joints between insulation boards should not coincide with those between the plywood sheets.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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.
- 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 Thermataper® TT47 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, wherever possible, be laid break-bonded and with joints lightly butted. There should be no gaps at abutments.
- Roof-light or ventilator kerbs etc. should always insulated to the same standard as the general roof area i.e. to the Annex C U-value of the tapered system.
- 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.

Mechanical Fixings

- The number of mechanical fixings required to fix *Kingspan Thermataper*® TT47 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 boards of *Kingspan Thermataper*® TT47 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 in an even pattern.
- Fasteners at insulation board edges must be located > 50 mm and < 150 mm from edges and corners of the board and not overlap board joints.
- Please refer to page 22 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 or more layers of insulation are to be installed, the packer boards should be mechanically fixed with minimum 1 No. fixing in the centre of the 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.

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 Thermataper*® TT47 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

- *Kingspan Thermataper*® TT47 LPC/FM is available through specialist insulation distributors and selected roofing merchants throughout the UK and Ireland.

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.co.uk/safety or www.kingspaninsulation.ie/safety.

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

Thermataper® TT47 LPC/FM Product Details

Product Description

Kingspan Thermataper® TT47 LPC/FM is the tapered version of *Kingspan Thermaroof®* TR27 LPC/FM.

The Facings

Kingspan Thermataper® TT47 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 Thermataper®* TT47 LPC/FM is manufactured with

Nilflam® technology, a 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).



Standards and Approvals

Kingspan Thermataper® TT47 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 Thermataper® TT47 LPC/FM is also manufactured to the highest standards under a management system certified to BS / I.S. EN ISO 9001: 2008 (Quality management systems. Requirements), BS / I.S. EN ISO 14001: 2004 (Environmental Management Systems. Requirements) and BS / I.S. OHSAS 18001: 2007 (Health and Safety Management Systems. Requirements).

Kingspan Thermataper® TT47 LPC/FM, produced at Kingspan Insulation's Pembridge and Selby manufacturing facilities, is covered by BBA Certificate 06/4372.



Standard Dimensions

Kingspan Thermataper® TT47 LPC/FM is available in the following standard size:

Nominal Dimension	Availability
Length (m)	1.2
Width (m)	1.2
Insulant Thickness (mm)	
Systems with a 1:30 & 1:40 fall	50 minimum
Systems with a 1:60 & 1:80 fall	25 minimum
Systems with a 1:120 fall	30 minimum
All systems	Unlimited maximum*

* Packer boards will be required above a specific thickness.

Taper Gradients

Kingspan Thermataper® TT47 LPC/FM is available ex stock in falls of 1:30, 1:40, 1:60 and 1:80. For information regarding tapered roof designs incorporating *Kingspan Thermataper®* TT47 in a wider range of falls please contact the Kingspan Insulation Tapered Roofing Department (see rear cover).

Compressive Strength

The compressive strength of *Kingspan Thermataper®* TT47 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 Thermataper®* TT47 LPC/FM should be installed over a vapour control layer or sealed metal deck (see 'Water Vapour Control' page 15).

Durability

If correctly installed, *Kingspan Thermataper®* TT47 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 Thermaaper*® TT46 LPC/FM, resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire Performance

Kingspan Thermaaper® TT47 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

Kingspan Thermaaper® TT47 LPC/FM, when subjected to the British Standard fire test specified in the table below, will achieve the result shown, when waterproofed with 3 layer built-up felt and a loading coat of 10 mm chippings. For specifications without the chippings please consult the manufacturer of the mineral surfaced cap sheet for their fire classification details.

Test	Result
BS 476-3: 1958 (External fire exposure roof test)	FAA Rating

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

Thermal Properties

The effective thermal conductivity and thermal resistance of the insulation in a tapered roofing system is specific to the individual roof design. The Kingspan Insulation Tapered Roofing Department (see rear cover for details) performs calculations to determine these values in accordance with Annex C of BS EN ISO 6946: 2007 (Building components and building elements – Thermal resistance and thermal transmittance – Calculation method) as part of the scheme design process.

LPCB & FM Certification

FM Certification

Kingspan Thermaaper® TT47 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 Thermaaper*® TT47 LPC/FM, produced at Kingspan Insulation's Pembridge and Castleblayney 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 Thermaaper*® TT47 LPC/FM. For further details please contact the Kingspan Insulation Technical Service Department (see rear cover) or alternatively search for "*Thermaaper*® TT47 LPC/FM" or approval reference number 388b/02 on www.redbooklive.com.

Product	Thickness (mm)	Vapour Control	Grade	LPCB Ref No.
<i>Kingspan Thermaaper</i> ® TT47 LPC/FM	30 – 120 in a single layer	Sealed metal deck or separate vapour control layer	EXT – B	388b/02

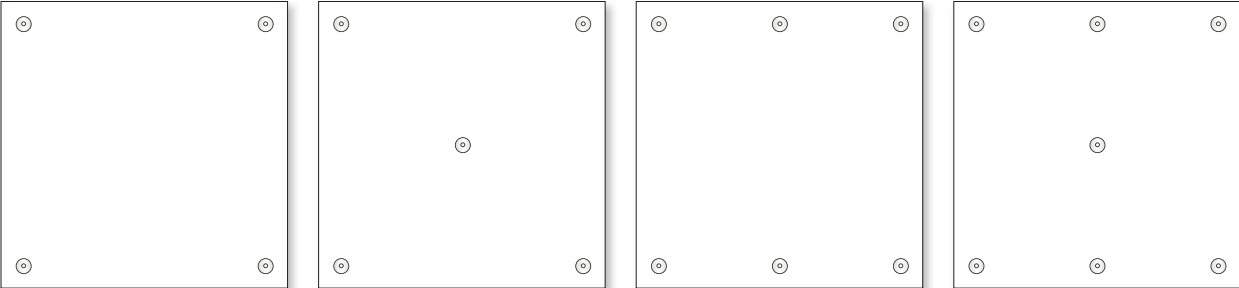


Mechanical Fixing Patterns

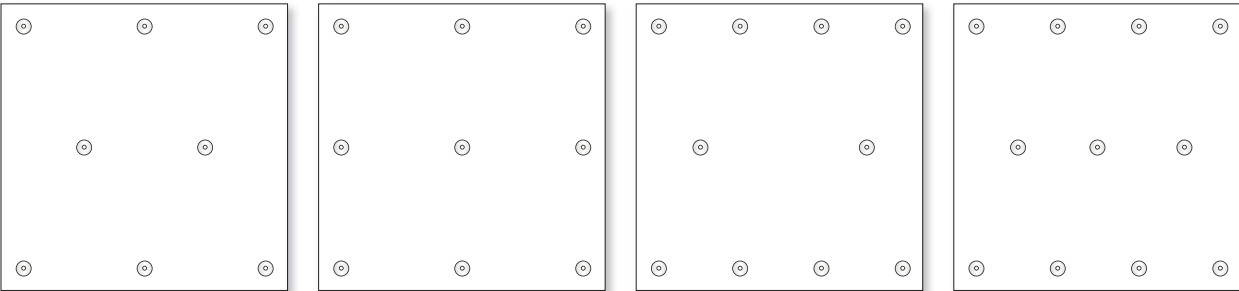
Recommended Fixing Patterns

The recommended fixing patterns for *Kingspan Thermataper*® TT46 LPC/FM and *Kingspan Thermataper*® TT47 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).

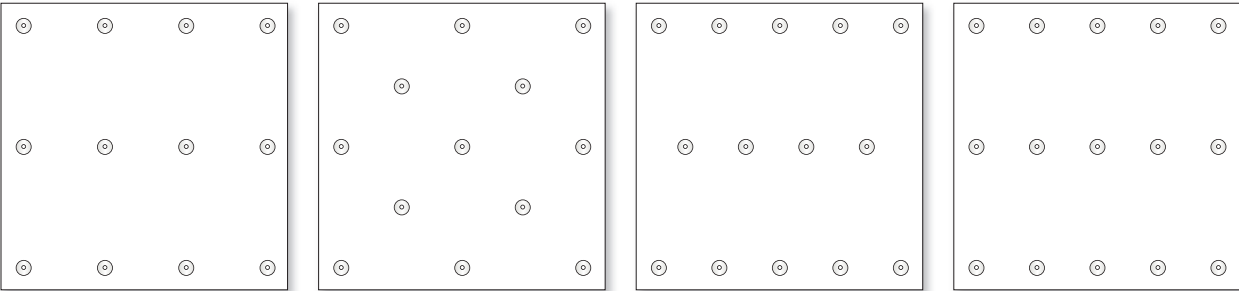
The images below show recommended fixing patterns, the number of fixings used and the resulting fixing density (number of fixings per m²).



4 No. per board (1.2 x 1.2 m board – 2.77 fixings / m²) 5 No. per board (1.2 x 1.2 m board – 3.47 fixings / m²) 6 No. per board (1.2 x 1.2 m board – 4.16 fixings / m²) 7 No. per board (1.2 x 1.2 m board – 4.86 fixings / m²)



8 No. per board (1.2 x 1.2 m board – 5.55 fixings / m²) 9 No. per board (1.2 x 1.2 m board – 6.25 fixings / m²) 10 No. per board (1.2 x 1.2 m board – 6.94 fixings / m²) 11 No. per board (1.2 x 1.2 m board – 7.63 fixings / m²)



12 No. per board (1.2 x 1.2 m board – 8.33 fixings / m²) 13 No. per board (1.2 x 1.2 m board – 9.02 fixings / m²) 14 No. per board (1.2 x 1.2 m board – 9.72 fixings / m²) 15 No. per board (1.2 x 1.2 m board – 10.41 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.

Kingspan Insulation

Company Details

Kingspan Insulation Ltd is part of the Kingspan Group plc., one of Europe's leading construction product manufacturers. The Kingspan Group was formed in the late 1960s and is a publicly quoted group of companies headquartered in Kingscourt, County Cavan, Ireland.

Kingspan Insulation Ltd is a market leading manufacturer of premium and high performance rigid insulation products and insulated systems for building fabric and building services applications.

Products & Applications

Kingspan Insulation Ltd has a vast product range. Kingspan Insulation Ltd products are suitable for both new build and refurbishment in a variety of applications within both domestic and non-domestic buildings.

Insulation for:

- Pitched Roofs
- Flat Roofs
- Green Roofs
- Cavity Walls
- Solid Walls
- Timber and Steel Framing
- Insulated Cladding Systems
- Insulated Render Systems
- Floors
- Soffits
- Ductwork

Further Solutions:

- Insulated Dry-Lining
- Tapered Roofing Systems
- Cavity Closers
- **Kingspan KoolDuct**® Pre-Insulated Ducting
- **Kingspan nilveni**® Breathable Membranes
- **Kingspan TEK**® Building System

Insulation Product Benefits

Kingspan Kooltherm® K-range Products

- With a thermal conductivity of 0.020–0.023 W/m·K these are the most thermally efficient insulation products commonly used.
- The thinnest commonly used insulation products for any specific U-value.
- Rigid thermoset insulation core is Class 0, as defined by the Building Regulations in England, Wales & Ireland, and Low Risk, as defined by the Building Standards in Scotland.
- Rigid thermoset insulation core achieves the best possible rating of < 5% smoke obscuration when tested to BS 5111: Part 1: 1974.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Kingspan Therma™ Range Products

- With a thermal conductivity of 0.022–0.027 W/m·K these are amongst the more thermally efficient insulation products commonly used.
- Each product achieves the required fire performance for its intended application.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Kingspan Styrozone® Range Products

- Rigid extruded polystyrene insulation (XPS) has the necessary compressive strength to make it the product of choice for specialist applications such as heavy duty flooring, car park decks and inverted roofing.
- Each product achieves the required fire performance for its intended application.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP).

All Products

- Their closed cell structure resists both moisture and water vapour ingress – a problem which can be associated with open cell materials such as mineral fibre and which can result in reduced thermal performance.
- Unaffected by air infiltration – a problem that can be experienced with mineral fibre and which can reduce thermal performance.
- Safe and easy to install – non-fibrous.
- If installed correctly, can provide reliable long term thermal performance over the lifetime of the building.

Contact Details

Customer Service

For quotations, order placement and details of despatches please contact the Kingspan Insulation Customer Service Department on the numbers below:

UK	- Tel:	+44 (0) 1544 388 601
	- Fax:	+44 (0) 1544 388 888
	- email:	customerservice@kingspaninsulation.co.uk
Ireland	- Tel:	+353 (0) 42 979 5000
	- Fax:	+353 (0) 42 975 4299
	- email:	info@kingspaninsulation.ie

Literature & Samples

Kingspan Insulation produces a comprehensive range of technical literature for specifiers, contractors, stockists and end users. The literature contains clear 'user friendly' advice on typical design; design considerations; thermal properties; sitework and product data.

Available as a complete Design Manual or as individual product brochures, Kingspan Insulation technical literature is an essential specification tool. For copies please contact the Kingspan Insulation Marketing Department, or visit the Kingspan Insulation website, using the details below:

UK	- Tel:	+44 (0) 1544 387 384
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	- www.kingspaninsulation.co.uk/literature	
Ireland	- Tel:	+353 (0) 42 979 5000
	- Fax:	+353 (0) 42 975 4299
	- email:	info@kingspaninsulation.ie
	- www.kingspaninsulation.ie/literature	

Tapered Roofing

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	- Fax:	+353 (0) 42 975 4296
	- email:	tapered@kingspaninsulation.ie

Technical Advice / Design

Kingspan Insulation supports all of its products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a computer-aided service designed to give fast, accurate technical advice. Simply phone the Kingspan Insulation Technical Service Department with your project specification. Calculations can be carried out to provide U-values, condensation / dew point risk, required insulation thicknesses etc... Thereafter any number of permutations can be provided to help you achieve your desired targets.

The Kingspan Insulation Technical Service Department can also give general application advice and advice on design detailing and fixing etc... Site surveys are also undertaken as appropriate.

The Kingspan Insulation British Technical Service Department operates under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U-value and Condensation Risk Calculations.



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	- email:	technical@kingspaninsulation.ie

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Kingspan Insulation Ltd. reserves the right to amend product specifications without prior notice. Product thicknesses shown in this document should not be taken as being available ex-stock and reference should be made to the current Kingspan Insulation price-list or advice sought from Kingspan Insulation's Customer Service Department (see above left). The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to uses described. Recommendations for use should be verified for suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation offers a Technical Advisory Service (see above), 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 this literature is current by contacting the Kingspan Insulation Marketing Department (see left).

Kingspan Insulation Ltd is a member of:

The Single Ply Roofing Association
The Mastic Asphalt Council (MAC)



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