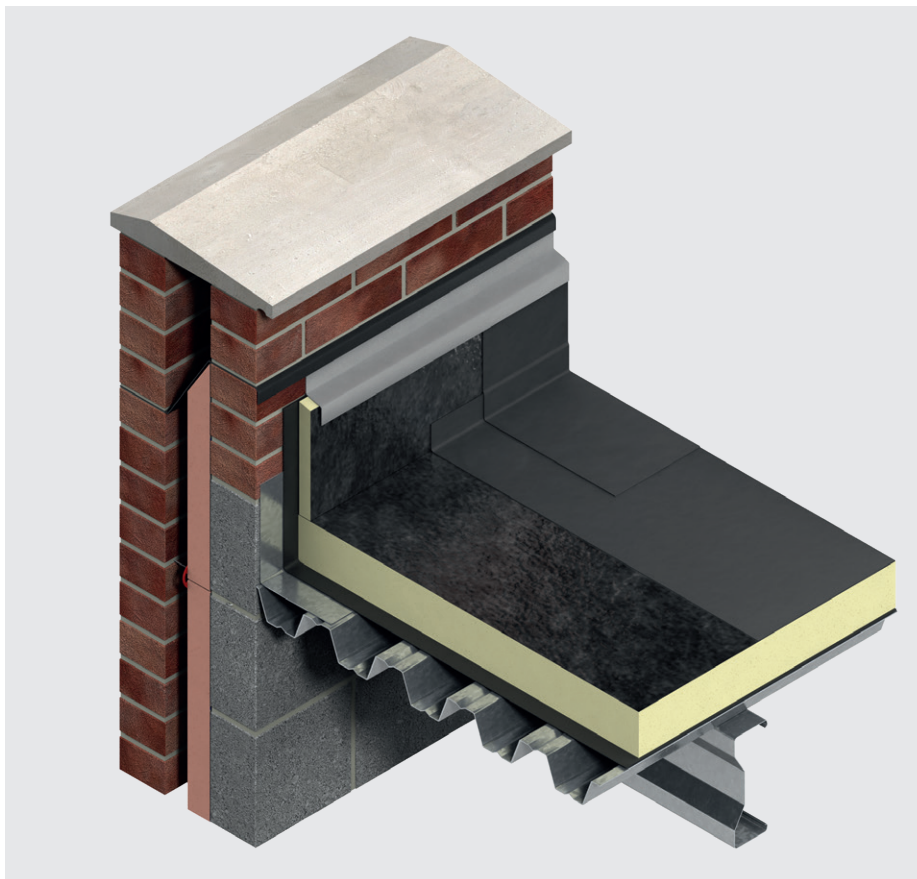


Thermataper® TT44 Systems

Tapered insulation for flat roofs waterproofed with partially bonded torch applied multi-layer bituminous waterproofing



- Insulation and drainage in one
- Compatible with majority of torch applied 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 compared to some other commonly used insulants
- Ideal for new build and refurbishment

Design considerations

Design services

Efficiency by design

Kingspan Thermataper® TT44 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. There are two Kingspan Thermataper TT44 Systems that can be used:

- Kingspan Thermataper® TT44 - comprises high performance rigid thermoset fibre-free polyisocyanurate (PIR) insulation; and
- Kingspan Thermataper® TT44-K Systems - combine the tapered insulation of Kingspan Thermataper® TT44 with a premium performance rigid thermoset phenolic Kingspan Kooltherm packer board, providing a slimmer solution.

Board layout & falls design

The design of the board layout and falls of a successful Kingspan Thermataper® TT44 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. On existing roofs, a free survey of the roof will be carried out by one of our experienced surveyors to collect the required information.

Kingspan Thermataper® TT44 Systems are flexible enough to be used for any design requiring a fall to perimeter gutters, valley gutters, or to any other outlet or location. Existing structures on the roof such as roof lighting or equipment can easily be accommodated into the design.

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. This service operates under a quality control system certified to ISO 9001: 2015 (Quality Management Systems. Requirements).

Once the final design has been accepted by the client and the Kingspan Thermataper® TT44 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® TT44 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: 2021 (Management of moisture 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® TT44 System, whilst also ensuring any condensation risk is within the limits given in BS 5250: 2021 (Management of moisture in buildings).

Calculation of U-values

Kingspan Thermataper® TT44 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 consult the Kingspan Insulation Tapered Roofing Department (see rear cover) for assistance.

U-values for Kingspan Thermataper® TT44 Systems are calculated in accordance with Annex E of BS EN ISO 6946: 2017 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods).

Linear thermal bridging

Basic principles

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

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

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

The lower the ψ-value, the better the performance. ψ-values are taken into account in the calculation methodologies e.g. the Standard Assessment Procedure (SAP) that are used to assess the operational CO₂ emissions and, where applicable, the fabric energy efficiency of buildings, primary energy or delivered energy rates.

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

Design considerations

Reducing linear thermal bridging

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

- Care is required to ensure continuation of insulation wherever possible between the wall and roof for best thermal performance. Where this is not possible, the roof and wall insulation should be overlapped and ideally, insulation material introduced between.
- Parapet detailing can represent a good, low heat loss approach, with insulation continuity maintained using an insulated upstand to reduce cold bridging. A minimum 30 mm thick Kingspan Thermaroof® TR24 upstand should be used around the perimeter of the roof on the internal façade of parapets. The upstand should extend a minimum of 150 mm above the roof insulation and achieve a minimum distance of 300 mm between the top of the insulation upstand and the bottom of the horizontal roof insulation. Wall insulation should be carried up into parapets at least as high as the flat roof insulation upstand.
- Lightweight aggregate blockwork to the inner leaf of wall constructions can help to improve thermal performance at junctions generally and where used for the inner leaf of parapet walls it can help to reduce losses.
- Where a parapet construction is not used, to achieve best performance, the roof insulation should be carried over the wall plate to meet and extend past the wall insulation layer. For a timber warm roof construction, the first joist zone above the wall plate can be filled with insulation for best performance and to maintain thermal continuity.
- For best thermal performance, roof-lights and ventilator kerbs should be insulated with the same thickness of Kingspan Thermaroof® TR24 as the general roof area.
- Where guttering is incorporated within a flat roof construction, this should be accounted for within the overall thermal design of the roof via an area-weighted calculation for the whole roof; the risk of localised interstitial condensation from reduced insulation provision at the gutter should be considered.

Environmental impact & responsible sourcing

Environmental Product Declaration

An Environmental Product Declaration (EPD), certified by BRE Global to the BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to BS EN 15804: 2012 + A1: 2013, has been created for Kingspan Thermataper® TT44 produced at Kingspan Insulation's Pembridge (Herefordshire) manufacturing facility.

Responsible sourcing

Kingspan Thermataper® TT44 produced at Kingspan Insulation's Pembridge (Herefordshire) manufacturing facility is manufactured under a management system certified to ISO 14001: 2015.

NB The above information is correct at the time of writing. Please confirm at the point of need by visiting the Kingspan Insulation website (see rear cover), from which copies of Kingspan Insulation's certificates can be obtained.

Sustainability & responsibility

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

A report covering the sustainability and responsibility of Kingspan Insulation Ltd's operations at its Pembridge (Herefordshire) manufacturing facility is available upon request from literature@kingspaninsulation.co.uk

Specification clause

Kingspan Thermataper® TT44 should be described in specifications as:

The roof insulation shall be Kingspan Thermataper® TT44 comprising a fibre-free rigid thermoset polyisocyanurate insulation core faced with a bitumen coated glass tissue finished with a thermofusible polypropylene fleece on its upper surface and a mineralised glass tissue on its lower surface. The product shall be manufactured in accordance with the requirements of BS EN 13165: 2012 + A2: 2016; under a management system certified to ISO 9001: 2015, ISO 14001: 2015, ISO 45001: 2018, ISO 50001: 2018 and ISO 37301: 2021; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

Kingspan Thermataper® TT44-K should be described in specifications as:

The roof insulation shall be Kingspan Thermataper® TT44-K comprising a fibre-free rigid thermoset polyisocyanurate insulation core faced with a bitumen coated glass tissue finished with a thermofusible polypropylene fleece on its upper surface and a mineralised glass tissue on its lower surface. The packer board shall be rigid thermoset phenolic Kingspan Kooltherm®, with a fibre-free core. The product shall be manufactured in accordance with the requirements of BS EN 13165: 2012 + A2: 2016; under a management system certified to ISO 9001: 2015, ISO 14001: 2015, ISO 45001: 2018, ISO 50001: 2018 and ISO 37301: 2021; by Kingspan Insulation Limited; and installed in accordance with the instructions issued by them.

Design considerations

Typical constructions

Metal deck with no ceiling - Kingspan Thermataper® TT44

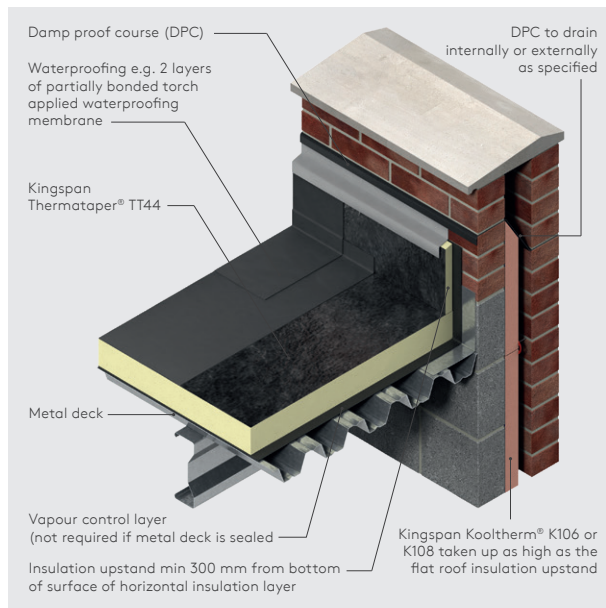


Figure 1

Dense concrete deck with suspended ceiling - Kingspan Thermataper® TT44-K

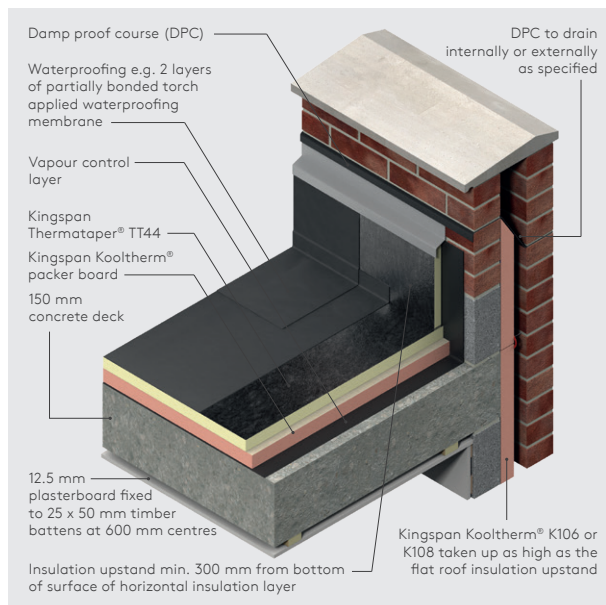


Figure 2

Product classifications

Uniclass UK

Pr_25_71_63_66 Polyisocyanurate (PIR) foam boards

CAWS

J41 420 and J42 420 (Standard and Intermediate)

J41 10 and J42 10 (Minor Works)

Details also available at source.thenbs.com.

Building Information Modelling (BIM)

BIM objects for Kingspan Thermataper® TT44 can be downloaded using the Kingspan BIM Designer Software Tool available at www.kingspaninsulation.co.uk/tt44.

Wind loadings

Wind loadings should be assessed in accordance with BS EN 1991-1-4: 2005 + A1: 2010 (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.

Roof waterproofing

Kingspan Thermataper® TT44 Systems are designed for use in conjunction with most partially bonded torch applied multi-layer bituminous waterproofing. When applying waterproofing, torch with minimum heat at all times. Torch the roll of waterproofing felt using flame / edge guards at all times.

Do not directly apply the torch to the insulation facing. The waterproofing membrane should be installed in accordance with the membrane manufacturer's instruction. For further advice please contact the Kingspan Insulation Technical Service Department (see rear cover).

Design considerations

Water vapour control

Kingspan Thermataper® TT44 Systems 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 (Kingspan Thermataper® TT44 only). 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 Thermataper® TT44 Systems are 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 (Kingspan Thermataper® TT44 only), 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 EN 13707: 2013 (Flexible sheets for waterproofing. Reinforced bitumen sheets for roof waterproofing. Definitions and characteristics), or SIP1 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 Thermataper® TT44 Systems are 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 promenade tiles. For further advice on the acceptability of specific foot traffic regimes, please contact the Kingspan Insulation Technical Service Department (see rear cover).

Spanning on metal decks (Kingspan Thermataper® TT44 only)

Insulation boards should comply with the minimum thicknesses shown in the table below, when used over metal decks with trough openings.

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
226 - 250	60

Green roofs

Green roof systems generally comprise of several layers, including: drainage layers, filter membranes, growing media and vegetation (either in the form of mats / blankets, plug-plants or seeded). They are designed to retain water within the growing media or substrate layer for successful plant growth, but are also engineered to drain water freely in order to prevent ponding. If green roofs become completely saturated with water, the plant roots will eventually rot leading to the failure of the vegetation layer. For this reason good drainage on the roof is essential for green roof plants.

The use of tapered insulation with a well designed green roof system allows the roof to drain-freely and reduces the risk of complete water saturation during extreme rainfall events.

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 EN 1991-1-4: 2005 + A1: 2010 (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 should be restrained by mechanical fixing or adhering (see Sitework). For further information please contact the Kingspan Insulation Technical Service Department (see rear cover).

Sitework

Pre-delivery

- Ensure that your drawing is the latest revision and is relevant to the roof being insulated.
- Check that any rainwater outlets, roof lights, obstructions such as tank rooms and dimensions on the drawing correspond to the roof. Should there be any discrepancy contact the Kingspan Insulation Tapered Roofing Department.

Delivery

- It is essential that quantities are checked against the delivery note upon receipt for the roof phase / area required.
- Ensure provisions are made to offload the delivery vehicle.

Pre-installation

- Ensure that vapour control layers (if required) are installed following the manufacturer's guidance.
- Surfaces should be level, clean, dry, and without large projections, steps or gaps before commencing installation.

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 3 and 4).

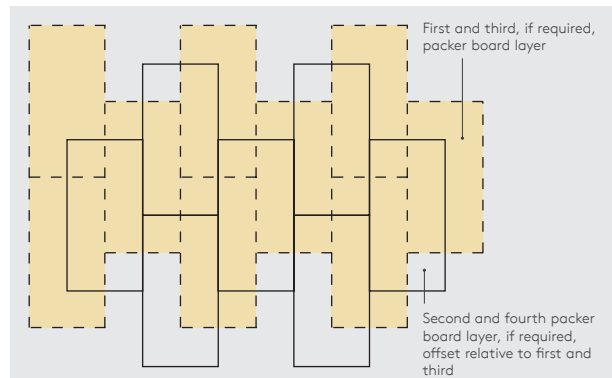


Figure 3: Offsetting of multiple packer board layers

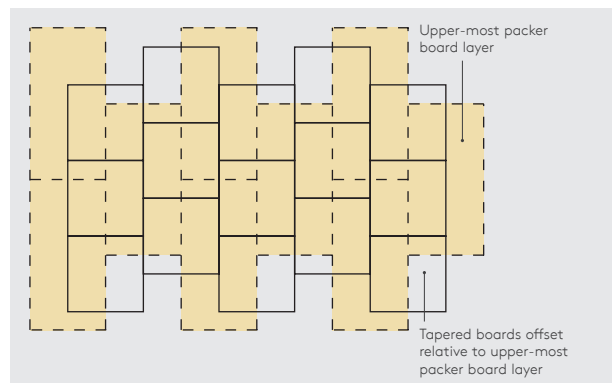


Figure 4: Offsetting of tapered boards relative to packer boards

Installing over metal decks (Kingspan Thermataper® TT44 only)

- 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.

Sitework

- 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® TT44 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 be insulated with the same thickness of Kingspan Thermarook® TR24 as the roof area.
- A 30 mm thick Kingspan Thermarook® TR24 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.
- 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 be insulated with the same thickness of Kingspan Thermarook® TR24 as the general roof area.
- A 30 mm thick Kingspan Thermarook® TR24 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.

Mechanically fixed systems (Kingspan Thermataper® TT44 only)

Installing over concrete decks

Bonded systems

- Concrete decks should be clean, dry, without large projections, steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- In order to ensure an adequate bond between the vapour control layer and the concrete deck, the 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® TT44 or Kingspan Thermataper® TT44-K 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.
- Concrete decks should be clean, dry, without large projections, steps or gaps, and should be graded to allow correct falls to all rainwater outlets.
- 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.
- 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 be insulated with the same thickness of Kingspan Thermarook® TR24 as the general roof area.
- A 30 mm thick Kingspan Thermarook® TR24 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

Bonded systems

- 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 bonded to it with hot bitumen, or suitable alternative proprietary adhesive system.
- 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® TT44 or Kingspan Thermataper® TT44-K 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.
- 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 be insulated with the same thickness of Kingspan Thermaroof® TR24 as the general roof area.
- A 30 mm thick Kingspan Thermaroof® TR24 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.

Mechanically fixed systems (Kingspan Thermataper® TT44 only)

- 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.
- 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.
- 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 be insulated with the same thickness of Kingspan Thermaroof® TR24 as the general roof area.
- A 30 mm thick Kingspan Thermaroof® TR24 upstand should be used around the perimeter of the roof on the internal façade of parapets.
- A minimum distance of 300 mm should be maintained between the top of the insulation upstand and the bottom of the horizontal roof insulation.
- The waterproofing membrane is installed in accordance with the membrane manufacturer's instructions, over the whole insulated area including any insulation upstands, as soon as possible after laying the insulation boards.

Installing over plywood decks

Kingspan Thermataper® TT44 and Kingspan Thermataper® TT44-K Systems only

- Boards of Kingspan Thermataper® TT44 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.
- The Kingspan Thermataper® TT44-K System should only be bonded down with the use of a suitable alternative (cold) proprietary adhesive system.
- Alternatively, Kingspan Thermataper® TT44 boards should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners (see 'Mechanical Fixings'). Mechanical fixings cannot be used with Kingspan Thermataper® TT44-K Systems (using a Kooltherm® Packer Board).
- 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.
- Joints between insulation boards should not coincide with those between the plywood sheets.
- Roof-light or ventilator kerbs etc. should always be insulated with the same thickness of Kingspan Thermataper® TT44 as the general roof area.

Sitework

Mechanical fixings (Kingspan Thermataper® TT44 only)

- The number of mechanical fixings required to fix Kingspan Thermataper® TT44 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 1.2 m boards of Kingspan Thermataper® TT44 to the deck.
- The requirement for additional fixings should be assessed in accordance with BS EN 1991-1.4: 2005 + A1: 2010 (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 10 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.

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 the direct 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.

Packaging and storage

- The polyethylene polythene 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.

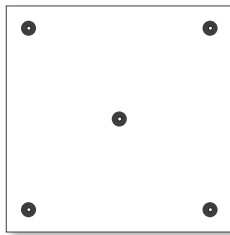
Warning - do not stand on or otherwise support your weight on this product unless it is fully supported by a load bearing surface.

Mechanical fixing patterns

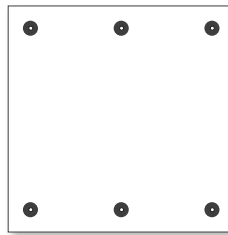
Recommended fixing patterns (Kingspan Thermataper® TT44 only)

The recommended fixing patterns for Kingspan Thermataper® TT44 are shown below. The number of fixings necessary should also be assessed in accordance with BS EN 1991-1-4: 2005 + A1: 2010 (National Annex to Eurocode 1. Actions on structures, General Actions, Wind Actions).

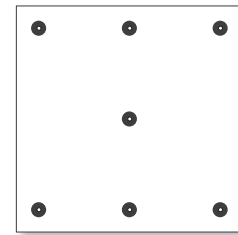
The images below show the minimum recommended fixing patterns, the number of fixings used and the resulting fixing density (number of fixings per m²).



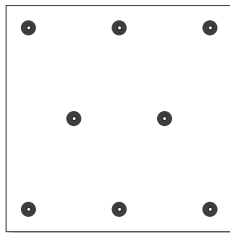
5 No. per board
(1.2 x 1.2 m board - 3.47 fixings / m²)



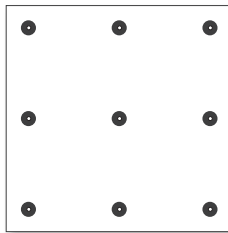
6 No. per board
(1.2 x 1.2 m board - 4.16 fixings / m²)



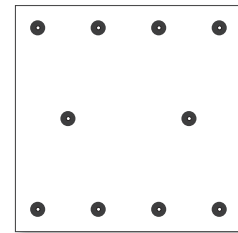
7 No. per board
(1.2 x 1.2 m board - 4.86 fixings / m²)



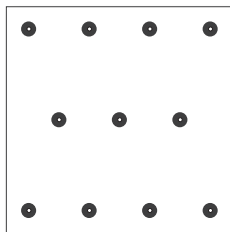
8 No. per board
(1.2 x 1.2 m board - 5.55 fixings / m²)



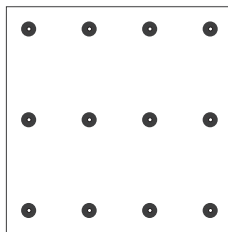
9 No. per board
(1.2 x 1.2 m board - 6.25 fixings / m²)



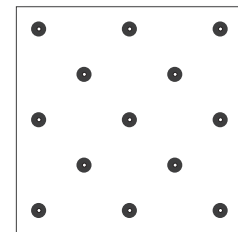
10 No. per board
(1.2 x 1.2 m board - 6.94 fixings / m²)



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)

Product details - Kingspan Thermataper® TT44

Product description

Kingspan Thermataper® TT44 is the tapered version of Kingspan Thermataper® TR24.

The upper facing

The upper facing of Kingspan Thermataper® TT44 is bitumen coated glass tissue finished with a thermofusible polypropylene fleece, autohesively bonded to the insulation core during manufacture.

The core

The core of Kingspan Thermataper® TT44 is manufactured with a fibre-free rigid thermoset polyisocyanurate (PIR) insulant.



The lower facing

The lower facing of Kingspan Thermataper® TT44 is a mineralised glass tissue autohesively bonded to the insulation core during manufacture.

Standards & approvals

Kingspan Thermataper® TT44 Systems are manufactured under a management system certified to ISO 9001: 2015 (Quality Management System), ISO 14001: 2015 (Environmental Management System), ISO 45001: 2018 (Occupational Health and Safety Management System), ISO 50001: 2018 (Energy Management System) and ISO 37301: 2021 (Compliance Management System).

Standard dimensions

Kingspan Thermataper® TT44 is available in the following standard size:

Nominal dimension		Availability
Length	(mm)	1200
Width	(mm)	1200
Insulant Thickness	(mm)	30 minimum

Taper gradients

Kingspan Thermataper® TT44 is available ex stock in a fall of 1:60. For information regarding tapered roof designs incorporating Kingspan Thermataper® TT44 in a wider range of falls please contact the Kingspan Insulation Tapered Roofing Department (see rear cover).

Compressive stress

The compressive stress of Kingspan Thermataper® TT44 exceeds 150 kPa at 10% compression, when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour).

Water vapour resistivity

The product achieves a resistivity greater than 300 MNs/gm, when tested in accordance with BS EN 12086: 2013 (Thermal insulating products for building applications. Determination of water vapour transmission properties). Kingspan Thermataper® TT44 Systems should always be installed over a vapour control layer or sealed metal deck (see 'Water vapour control' on page 5).

Durability

If correctly installed, Kingspan Thermataper® TT44 Systems will remain effective for the life of the building. 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 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 Thermataper® TT44 Systems resist attack by mould and microbial growth and do not provide any food value to vermin.

Product details - Kingspan Thermataper® TT44

Fire performance

For guidance regarding the routes to compliance for meeting the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.

Under System 4 AVCP, Kingspan Thermataper® TT44 has a Euroclass rating of F.

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

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

NB Test evidence to demonstrate compliance with the fire safety requirements of the Building Regulations / Standards incorporating Kingspan Thermataper® TT44 within a roof system should be provided by the chosen waterproofing system supplier. Without the required classification for the proposed roof system, achieved through either an external roof exposure test or an overlay of inorganic material, the use of Kingspan Thermataper® TT44 must be restricted to at least 20 metres in England and 24 metres in Scotland, or more from any point of the relevant boundary.

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

Thermal properties

The 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 E of BS EN ISO 6946: 2017 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods) as part of the scheme design process.

Thermal conductivity (maximum)

- 0.024 W/mK (≥ 120 mm)
- 0.025 W/mK (80 - 119 mm)
- 0.027 W/mK (< 80 mm)

Product details - Kingspan Kooltherm[®] packer board

Product description

Kingspan Thermataper[®] TT44-K combines the tapered insulation of Kingspan Thermataper[®] TT44 with a Kingspan Kooltherm[®] packer board.

Please refer to page 11 for product details for Kingspan Thermataper[®] TT44 insulation boards.

The facings

The Kingspan Kooltherm[®] packer board is faced on both sides with a glass tissue based facing, autohesively bonded to the insulation core during manufacture.

The core

The core of the Kingspan Kooltherm[®] packer board is a fibre-free rigid thermoset phenolic insulant.



Standards & approvals

The Kingspan Kooltherm[®] packer board is manufactured under a management system certified to ISO 9001: 2015 (Quality Management Systems), ISO 14001: 2015 (Environmental Management Systems), ISO 45001: 2018 (Occupational Health and Safety Management Systems), ISO 50001: 2018 (Energy Management System) and ISO 37301: 2021 (Compliance Management System).

Standard dimensions

The Kingspan Kooltherm[®] packer board is available in the following standard size:

Nominal dimension		Availability
Length	(mm)	1200
Width	(mm)	1200
Insulant Thickness	(mm)	60, 80, 120

Compressive strength

The compressive strength of the Kingspan Kooltherm[®] packer board exceeds 120 kPa at 10% compression, when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour).

Water vapour resistivity

The product achieves a resistivity greater than 300 MNs/gm, when tested in accordance with BS EN 12086: 2013 (Thermal insulating products for building applications. Determination of water vapour transmission properties). Kingspan Thermataper[®] TT44 Systems should always be installed over a vapour control layer or sealed metal deck (see 'Water vapour control' on page 5).

Durability

If correctly installed, the Kingspan Kooltherm[®] packer board will remain effective for the life of the building. 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 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 the Kingspan Kooltherm[®] packer board resist attack by mould and microbial growth and do not provide any food value to vermin.

Product details - Kingspan Kooltherm[®] packer board

Fire performance

For guidance regarding the routes to compliance for meeting the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.

The Kingspan Kooltherm[®] packer board achieves European Classification (Euroclass) C-s2,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).

Test report number	EUI-21-SBI-000074 and EUI-21-SF-000074
Classification report number	EUI-21-000074-Revision1
Product thickness (mm)	60 - 120
Substrate	Valid with any substrate, except plasterboards, of at least A2-s1,d0 class and at least 652.5 kg/m ³ density
Joints / edges	Vertical and horizontal joints and any edge type

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

Thermal properties

The λ -values and R-values detailed below are quoted in accordance with BS EN 13166: 2012 + A2: 2016 (Thermal insulation products for buildings. Factory made phenolic foam (PF) products. Specification).

Thermal conductivity

The boards achieve a thermal conductivity (λ -value) of 0.019 W/mK.

The Kooltherm packer boards achieve a thermal conductivity (λ -value) of 0.019 W/mK.

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 (m²K/W).

Insulant thickness (mm)	Thermal resistance (m ² K/W)
60	3.15
80	4.20
100	5.25
120	6.30

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

About 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 rigid insulation products and insulated systems for building fabric and building services applications.

Products & solutions

Rigid insulation products for building fabric applications, including roofs, walls and floors.

- Kingspan AlphaCore® - microporous silica-based insulation.
- Kingspan OPTIM-R® - vacuum insulation panel (VIP) systems.
- Kingspan Kooltherm® - phenolic insulation.
- Kingspan Therma™ - PIR insulation.
- K-Roc® - rock mineral fibre insulation.
- Kingspan GreenGuard® - extruded polystyrene insulation (XPS).
- Kingspan TEK® - structural insulated panels (SIPs).
- Cavity closers - PVC-U extrusions with an insulation core.
- Membranes - for pitched roofs and walls.

Services

Our support services provide fast and accurate advice no matter what your role is. Visit our website to access the following services.

- U-value calculations - free, quick and easy U-value calculations with our U-value Calculator.
- Help and advice on your projects, including stockists, how to guides, regulatory guidance and e-learning.
- Building Information Modelling (BIM) - download BIM objects for our products.
- Tapered roofing service - Kingspan Insulation's tapered roofing systems come with a supporting design service to ensure the most cost-effective solution for a roof is identified.
- CPDs - Kingspan Insulation offer a number of free CPD seminars for architects and specifiers covering a wide range of industry topics. CPDs can be booked or a range of online learning courses can be found online.

Planet Passionate

Planet Passionate is our 10 year global sustainability programme that aims to tackle three big global challenges: climate change, circularity and protection of the natural world.

Through our measurable targets across four focus areas (carbon, energy, circularity and water), we are committed to delivering the following by 2030:

- Energy: powering 60% of all Kingspan operations directly from renewable energy with a minimum of 20% of this energy generated on manufacturing sites.
- Carbon: achieving net zero carbon manufacturing and a 50% reduction in product CO₂ intensity from primary supply partners.
- Circularity: upcycling of 1 billion PET bottles per annum into our manufacturing processes plus zero company waste to landfill across all sites.
- Water: harvesting 100 million litres of rainwater annually on our sites.

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