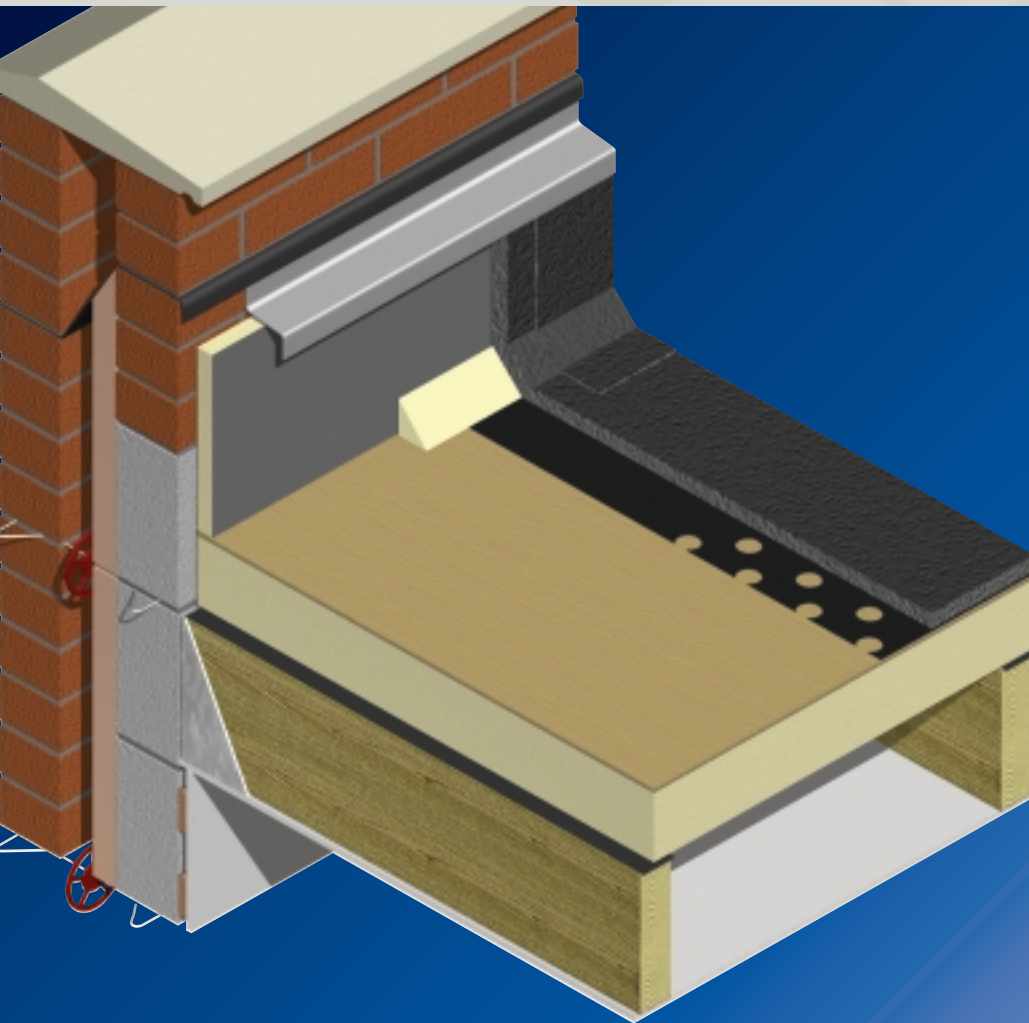


ThermaTMroof TR3 1

STRUCTURAL 6 mm PLYWOOD COMPOSITE INSULATION BENEATH PARTIALLY BONDED BUILT-UP FELT

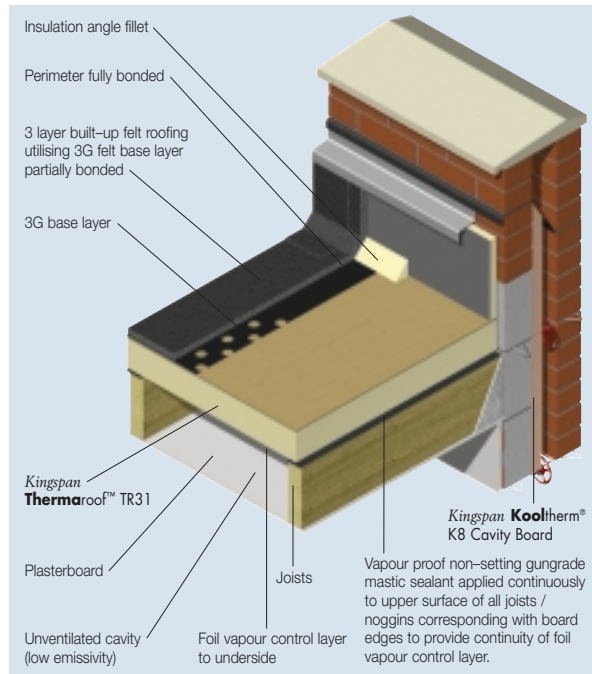


- High performance rigid urethane insulation – thermal conductivity 0.023 W/m-K
- Insulation, vapour control layer and decking in one board
- Proven reputation as a quality composite roof deck
- Watertightness is achieved quickly
- Inexpensive installation costs
- Resistant to the passage of water vapour
- Easy to handle and install
- Ideal for new build and refurbishment
- Non-deleterious material
- CFC/HCFC-free with zero Ozone Depletion Potential (ODP)



Typical Design Details

3 Layer Built-up Felt Waterproofing



Specification Clause

Kingspan **Therma^{roof}™ TR31** should be described in specifications as:-

The roof insulation shall be **Kingspan Therma^{roof}™ TR31** comprising a minimum 6 mm WBP exterior grade plywood upper facing bonded to a ____mm thick CFC/HCFC-free rigid insulation urethane core with a lower facing of low emissivity composite foil manufactured to the highest standards under quality control systems approved to BS EN ISO 9001: 2000 / I.S. EN ISO 9001: 2000 by Kingspan Insulation Limited and shall be applied in accordance with the instructions issued by them.

Details also available in NBS Plus.

NBS users should refer to clause(s):

J41 420, J41 430 (Standard and Intermediate)

J41 10 (Minor Works)



Design Considerations

Sustainability

In the past, erroneously, the relative environmental sustainability of insulation materials has been compared on the basis of embodied energy and ozone depletion potential. It is now recognised that a much wider basket of embodied environmental impacts (including those caused by their embodied energy), rather than embodied energy alone, is the only credible tool of comparison. Time has also annulled ozone depletion potential as an issue as all insulation materials are now banned from using CFC and HCFC blowing agents by law.

For buildings designed to today's Building Regulations energy use standards it is now also known that the embodied environmental impacts of all of the materials and labour used to create a building are insignificant in comparison with the lifetime operational environmental impacts of that building, and so are of very limited importance. Since it is operational energy use that creates the vast majority of operational environmental impact, saving energy by specifying the lowest U-values possible is the most environmentally sustainable action to take.

However, one of the most neglected facts about environmentally sustainable buildings is that the longevity of their standards of operational energy use, and therefore the longevity of their operational environmental impacts, is critical. The performance of some insulants, such as mineral fibre, can deteriorate rapidly if exposed to water penetration, air movement or compression. This may increase operational energy use and hence compromise the environmental sustainability of the finished building to an alarming degree. Other insulation materials, such as rigid phenolic or rigid urethane, are not vulnerable to any of these problems.

In summary, designers should:

- (a) specify the lowest possible U-value regardless of insulation type;
- (b) design out the risk of their chosen insulant not performing as specified; and
- (c) if the latter is not possible, choose an insulant that is at low risk of failure e.g. a cellular plastic insulation material.

However, manufacturers should not rest on their laurels; it is a matter of social responsibility to be open and honest about the environmental impact of the manufacture of a product, and a full Life Cycle Analysis (LCA) based on a much wider basket of environmental impacts, rather than embodied energy alone, is recognised as the preferred tool to achieve this. Kingspan Insulation was the first insulation manufacturer to openly complete and publish independently certified Ecoprofiles (a type of LCA) on its product ranges. The Ecoprofile for the **Kingspan Therma™** range of rigid urethane insulation products was performed by Building Research Establishment (BRE). The product range comfortably achieves a BRE Green Guide A rating.



But there is far more to sustainability than whether or not a product, process or company affects the environment in a positive or a negative way. A company can, and should, demonstrate its financial viability and social responsibility, as well as ensure that its materials and methods do not add unduly to the burden placed on the planet.

Kingspan Insulation has now put the manufacture of its products at its Pembridge facility in Herefordshire through a rigorous independent appraisal of its economic, social, environmental and natural resource impacts using Arup's SPeAR® tool.

The results show a well balanced performance in terms of sustainability, and that Kingspan Insulation is already meeting legislation or best practice in most areas, even moving beyond best practice in some. Kingspan Insulation is the first and only construction material manufacturer to have taken this bold move and openly publish the results.

Wind Loading

Wind loadings should be assessed in accordance with BS 6399-2: 1997 (Loading for buildings. Code of practice for wind loads).

Roof Waterproofing

Kingspan Thermaroof™ TR31 is suitable for use with built up felts and mastic asphalt (see 'Waterproofing', page 5).

Consideration should be given to the recommendations of BS 8217: 2005 (Reinforced bitumen membranes for roofing. Code of practice) and BS 8218: 1998 (Code of practice for mastic asphalt roofing).

Falls

The falls on a flat roof should be smooth and steep enough to prevent the formation of rainwater pools. To ensure adequate drainage, BS 6229: 2003 (Flat roofs with continuously supported coverings. Code of practice), recommends uniform gradients of not less than 1 in 80. However, because of building settlement, it is advisable to 'design in' even greater falls. The fall on a flat roof constructed using *Kingspan Thermaroof™* TR31 is normally provided by the supporting structure being directed towards the rainwater outlets. However, because of building settlement, it is advisable to design in even greater falls. These can be provided by the use of a Kingspan Insulation Tapered Roofing System. Further details of the *Kingspan Thermataper®* range and a complete design service are available from the Kingspan Insulation Tapered Roofing Department (see rear cover).

Cold 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 to a similar standard as the general roof area. A 25 mm thick insulation upstand of at least 150 mm should be used around the perimeter of the roof on the internal façade of the parapet. The exposed face of the insulation must be lined with 20 mm exterior grade plywood prior to the application of the waterproofing layer. Wall insulation should also be carried up into the parapet creating an 'overlap' of insulation. Please contact the Kingspan Insulation Technical Service Department (see rear cover) for further advice.

Water Vapour Control

The use of *Kingspan Thermaroof™* TR31 as the structural roof deck and insulation combined makes the provision of a separate vapour control layer unnecessary. By utilising the water vapour resistant characteristics of the board and combining these with the use of a suitable water vapour resistant mastic sealant applied to the upper surface of all supporting timbers, a perfectly adequate water vapour control layer can be formed, (see 'Vapour Control Layer').

Roof Loading

Kingspan Thermaroof™ TR31 is suitable for use on maintenance access roofs subject to limited foot traffic. Supporting joists should be placed at maximum 600 mm centres and noggins should be provided to coincide with the board edges. Where regular foot traffic or excessive loadings are liable to occur it is recommended that the supporting roof joists are spaced at maximum 400 mm centres. Again noggins, as described above, should be provided. The surface of heavily trafficked roofs should be protected by promenade tiles. The roof should be adequately protected when building works are being carried out on or over the roof surface. This is best achieved by close boarding.

Ceiling Details

The underside of *Kingspan Thermaroof™* TR31 is not suitable to form a decorative internal finish to the roof. Therefore, it is recommended that *Kingspan Thermaroof™* TR31 should always be underdrawn by a separate ceiling such as plasterboard or similar fire resistant material. Where the roof joists are to be left exposed the plasterboard should be fixed so as to create a minimum 25 mm cavity between the *Kingspan Thermaroof™* TR31 and the ceiling.

Typical U-values

The following examples have been calculated using the Combined Method for compliance with Building Regulations / Standards revised after 2002. These examples are based on the use of **Kingspan Therma^{roof}™ TR31** mechanically fixed to 150 mm timber roof joists waterproofed using 3 layer partially bonded built-up bitumen felt waterproofing with the surface covered by mineral chippings. The ceiling is taken to be a 3 mm skim coated 12.5 mm plasterboard with a non-ventilated low emissivity cavity between it and the underside of the deck. If your construction is any different, please consult the Kingspan Insulation Technical Service Department (see rear cover).

Combined Method – U-values were calculated using the method which has been adopted to bring National standards in line with the European Standard calculation method, BS / I.S. EN ISO 6946: 1997 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method).

NB When calculating U-values to BS / I.S. EN ISO 6946: 1997, the type of mechanical fixing used may change the thickness of insulation. For the purpose of these calculations, the use of galvanised ring shank nail fixings with a cross sectional area of 10.75 mm² has been assumed for insulant thicknesses up to and including 50 mm. The use of low profile oval head fixings with a cross sectional area of 16.0 mm² has been assumed for insulant thicknesses over 50 mm. For the purposes of these calculations the standard of workmanship has been assumed good and therefore the correction factor for air gaps has been ignored.

NB The figures quoted are for guidance only. A detailed U-value calculation together with condensation risk analysis should be completed for each individual project. Please call the Kingspan Insulation Technical Service Department (see rear cover).

Timber Deck with Plasterboard Ceiling

Product Thickness* (mm)	U-value (W/m ² ·K)	
	Joists at	
	400 Cntrs	600 Cntrs
56	0.36	0.36
61	0.33	0.33
66	0.31	0.31
76	0.28	0.28
81	0.27	0.27
86	0.25	0.25
96	0.23	0.23
106	0.21	0.21
116	0.20	0.20
126	0.19	0.19

*Product thickness = insulant thickness + 6 mm plywood.

For U-values below 0.19 W/m²·K we recommend the additional use of **Kingspan Kooldherm® K7** Pitched Roof Board between joists (see Vapour Control Layer).

Kingspan Kooldherm® K7 Pitched Roof Board Product Thickness (mm)	U-value (W/m ² ·K)	
	Joists at	
	400 Cntrs	600 Cntrs
20*	0.18	0.18
30*	0.17	0.17
40*	0.16	0.16
50*	0.16	0.15

*Thickness of Kingspan **Kooldherm®** K7 between the timber joists in conjunction with 116 mm Kingspan **Therma^{roof}™** TR31.

Sitework

Fixing

*Kingspan Therma*roof™ TR31, board size 2.4 x 1.2 m should be fixed, plywood uppermost, directly onto minimum 50 mm wide joists set at 600 mm maximum centres for maintenance access purposes or 400 mm centres maximum where regular foot traffic is expected. The board length should be laid along the joists. Board joints should be staggered (broken) and butted (approximately 2 mm gap) ensuring there is a minimum bearing of 20 mm per board edge over the supporting timber. In all cases, timber noggins (minimum 50 mm x 50 mm) should be adopted to fully support all free edges that are unsupported e.g. short board edges, trimmers to openings etc. Where two boards are secured to the same joist, nail / screws should be staggered.

Refer to:

EJOT UK Limited	+44 (0)1977 687 040
Flat Roofing Supplies	+44 (0)1293 590 970
SFS Intec Limited	+44 (0)1132 085 500
Suretivist	+44 (0)1279 505 514

Vapour Control Layer

In an effort to maintain a continuous vapour control layer to the foil underside, a non-setting gun-grade mastic bead sealant, wide enough to accommodate two board edges butted side by side, should be applied to the upper surface of all supporting joists and noggins.

When *Kingspan Kooltherm*® K7 Pitch Roof Board, in conjunction with *Kingspan Therma*roof™ TR31, is installed between timber joists a condensation risk analysis will have to be undertaken to determine the specification and position of the vapour control layer. Please contact the Kingspan Insulation Technical Service Department (see rear cover) who can carry out condensation risk analysis in accordance with BS: 5250.

Refer to:

Adshead Ratcliffe & Co Ltd	+44 (0)1773 826 661
C M Sealants	+44 (0)208 519 6358

Insulant Thickness up to 50 mm

*Kingspan Therma*roof™ TR31 up to 50 mm insulant thickness should be fixed with suitable galvanised ring-shank nails. These are to be placed at 100 mm centres around the board edges and at 300 mm centres along any intermediate supporting timbers.

Insulant Thickness over 50 mm

*Kingspan Therma*roof™ TR31 over 50 mm insulant thickness should be fixed with suitable low profile oval head screw fixings. These are to be placed at 200 mm centres around the board edges and at 300 mm centres along any intermediate supporting timbers.

The board fixings should be staggered and not less than 10 mm from board edges and not less than 50 mm from board corners. Fixings should penetrate supporting timbers by 35 mm depth minimum.

When securing boards, whether nailing or screwing, care must be taken not to over-drive / screw. Nails / screw heads should be flush with the plywood surface.

Care should be taken to ensure that the *Kingspan Therma*roof™ TR31 is kept dry. Lay only as much board as can be reasonably waterproofed in the working day.

Waterproofing

The plywood surface of *Kingspan Therma*roof™ TR31 is suitable for the application of 3 layer partially bonded felt incorporating the 3G base layer to BS 747: 2000 (Reinforced bitumen sheets for roofing. Specification).

Where the intended waterproofing is to be 2 layer fully bonded felt or mastic asphalt, it is recommended that an overlay of a 13 mm bitumen impregnated fibre board to BS EN 622 (Fibreboards. Specifications) or similar approved is fixed to the plywood surface of the *Kingspan Therma*roof™ TR31 using hot bitumen bonding, or by felt nailing.

The fibreboard acts as a surface to allow fully bonding of 2 layer built-up felt or a heat soak for mastic asphalt.

Mastic asphalt should always be laid in accordance with BS 8218: 1998 over an isolating layer of type 4A sheathing felt to BS 747: 2000.

Certain approved single-ply membranes are also compatible.

Reflective Coatings

Bitumen based built up waterproofing systems laid over *Kingspan Therma*roof™ TR31 should always incorporate a solar reflective layer such as chippings or specialist coatings.

Therma^{roof}™ TR31

Daily Working Practice

Kingspan Therma^{roof}™ TR31 should not be considered as temporary waterproofing. Boards should be waterproofed as soon as possible after fixing.

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 of the roof construction.

Cutting

Cutting should be carried out by using a fine toothed saw to fit roof openings and fixtures. Do not attempt to snap the board. Ensure accurate trimming to achieve close butting joints and continuity of insulation.

Availability

Kingspan Therma^{roof}™ TR31 is available through specialist insulation distributors and selected roofing merchants throughout the UK, Ireland and Europe.

Packaging

The boards are supplied in labelled packs shrink-wrapped in polythene.

Storage

The polythene packaging of Kingspan Insulation products should not be considered adequate for long term 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 a 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 leaflet on this topic which satisfies the requirements set out in the Control of Substances Hazardous to Health Regulations 1988 (COSHH) is available from the Kingspan Insulation Marketing Department (see rear cover).

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 this board unless it is fully supported by a load bearing surface.

Product Description

The Upper Facing

The upper facing of *Kingspan Therma^{roof}™ TR31* is 6 mm WBP exterior grade plywood.

The Core

The core of *Kingspan Therma^{roof}™ TR31* is manufactured from trademarked  **Nilflam**® technology (a high performance CFC/HCFC-free polyisocyanurate (PIR) based formulation). *Kingspan Therma^{roof}™ TR31* has a typical density of 32 kg/m³.

The Lower Facing

The lower facing of *Kingspan Therma^{roof}™ TR31* is a low emissivity composite foil which is highly resistant to the transmission of water vapour. This reflective, low emissivity surface effectively doubles the thermal resistance of the cavity in which the board is placed.

CFC/HCFC-free

Kingspan Therma^{roof}™ TR31 is manufactured without the use of CFCs/HCFCs and has zero Ozone Depletion Potential (ODP).



Product Data

Standards and Approvals

Kingspan Therma^{roof}™ TR31 is manufactured to the highest standards under quality control systems approved to BS EN ISO 9001: 2000 / I.S. EN ISO 9001: 2000 (Quality management systems. Requirements). systems. Requirements).



Manufactured to BS EN ISO 9001: 2000
Certificate No. 388



I.S. EN ISO 9001: 2000
Registration No. 19.0633

Standard Dimensions

Kingspan Therma^{roof}™ TR31 is available in the following standard size:

Nominal Dimension		Availability
Length	(m)	2.4
Width	(m)	1.2
Plywood Thickness	(mm)	6
Insulant Thickness	(mm)	Refer to local distributor or Kingspan Insulation price list for current stock and non-stock sizes.

Compressive Strength

The compressive strength of *Kingspan Therma^{roof}™ TR31* typically exceeds 150 kPa at 10% compression and 125 kPa at 5% when tested to BS EN 826: 1996 (Thermal insulating products for building applications. Determination of compression behaviour).

Water Vapour Resistance

Modified to include board facings, the boards achieve a resistance far greater than 100 MN-s/g when tested in accordance with BS 4370-2: 1993 (Methods of test for rigid cellular materials. Methods 7 to 9). When the joints between boards are sealed by the application of a continuous mastic sealant to the whole of the upper surface of the joists and cross noggins, a vapour resistance greater than 1000 MN-s/g is achieved.

Durability

If correctly applied, *Kingspan Thermaroof™* TR31 has an indefinite life. Its durability depends on the supporting structure and the conditions of its use.

Resistance to Solvents, Fungi & Rodents

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

The insulation core and facings used in the manufacture of *Kingspan Thermaroof™* TR31 resist attack by mould and microbial growth, and do not provide any food value to vermin.

Fire Performance

Kingspan Thermaroof™ TR31 when subjected to British Standard fire tests achieve the following typical results 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.

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

Test	Result
BS 476: Part 3: 1975 (External fire exposure roof test)	FAA rating
BS 476-3: 1958 (External fire membrane adopted exposure roof test)	Dependant on single-ply membrane adopted
BS 476-7: 1997 (Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products)	Class 1 rating

Thermal Properties

The λ -values and R-values quoted are in accordance with the Harmonised European Standard BS EN 13165: 2001 (Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification) using so called 90 / 90 principles. Comparison with alternative products may not be appropriate unless the same procedures have been followed.

Thermal Conductivity

Thermal conductivity (λ -value) of the plywood component of *Kingspan Thermaroof™* TR31 should be taken as 0.14 W/m-K.

The thermal conductivity of the insulation core of *Kingspan Thermaroof™* TR31 is 0.023 W/m-K.

Thermal Resistance

Thermal resistance (R-value) varies with the thickness of each component. It is calculated by dividing the thickness of each component (expressed in metres) by its thermal conductivity and adding the resultant figures together.

Product Thickness* (mm)	Thermal Resistance (m ² ·K/W)
56	2.20
61	2.40
66	2.65
76	3.05
81	3.30
86	3.50
96	3.95
106	4.35
116	4.80
126	5.25

*Product thickness = insulant thickness + 6 mm plywood.

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

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) 870 850 8555
	- Fax:	+44 (0) 870 850 8666
	- email:	commercial.uk@insulation.kingspan.com
Ireland	- Tel:	+353 (0) 42 97 54200
	- Fax:	+353 (0) 42 97 54299
	- email:	commercial.ie@insulation.kingspan.com

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 on the numbers below:

UK	- Tel:	+44 (0) 870 733 8333
	- Fax:	+44 (0) 1544 387 299
	- email:	literature.uk@insulation.kingspan.com
Ireland	- Tel:	+353 (0) 42 97 54298
	- Fax:	+353 (0) 42 97 54299
	- email:	literature.ie@insulation.kingspan.com

Tapered Roofing

For technical guidance, quotations, order placement and details of despatches please contact the Kingspan Insulation Tapered Roofing Department on the numbers below:

UK	- Tel:	+44 (0) 870 761 7770
	- Fax:	+44 (0) 1544 387 289
	- email:	tapered.uk@insulation.kingspan.com
Ireland	- Tel:	+353 (0) 42 97 54297
	- Fax:	+353 (0) 42 97 54296
	- email:	tapered.ie@insulation.kingspan.com

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.

Please contact the Kingspan Insulation Technical Service Department on the numbers below:

UK	- Tel:	+44 (0) 870 850 8333
	- Fax:	+44 (0) 1544 387 278
	- email:	techline.uk@insulation.kingspan.com
Ireland	- Tel:	+353 (0) 42 97 54297
	- Fax:	+353 (0) 42 97 54296
	- email:	techline.ie@insulation.kingspan.com

General Enquiries

For all other enquiries contact Kingspan Insulation on the numbers below:

UK	- Tel:	+44 (0) 870 850 8555
	- Fax:	+44 (0) 870 850 8666
	- email:	info.uk@insulation.kingspan.com
Ireland	- Tel:	+353 (0) 42 97 54200
	- Fax:	+353 (0) 42 97 54299
	- email:	info.ie@insulation.kingspan.com

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 as to the suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation 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 the literature is current by contacting the Kingspan Insulation Marketing Department (see left).



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