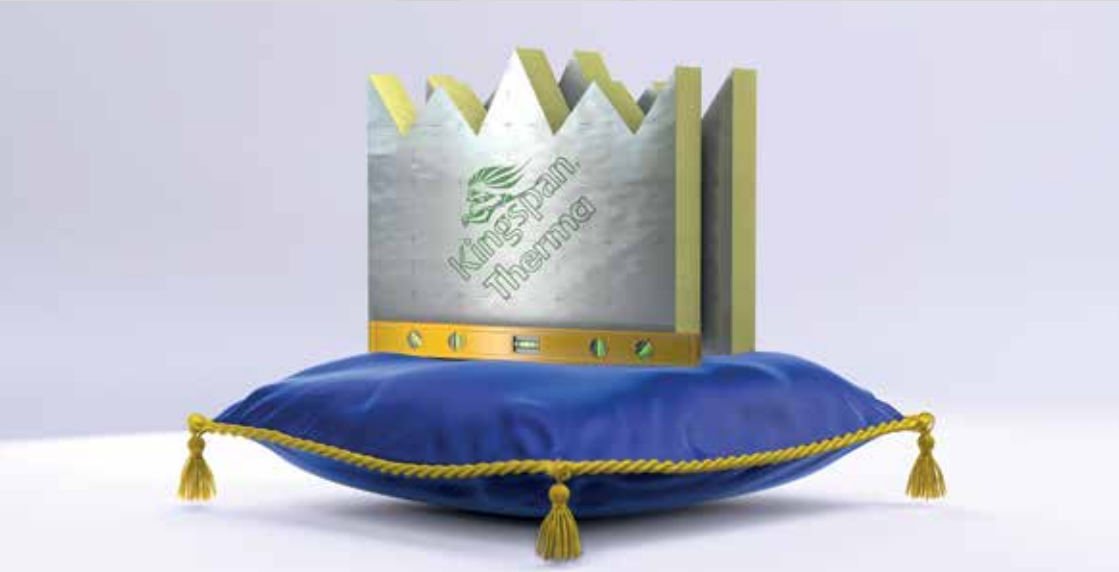
Insulation

Second Issue November 2016

Therma™ Quick Guide



Building a better Kingdom together.

Fibre-free Core

Kingspan®

Low Energy –
Low Carbon Buildings

Contents

About Kingspan Insulation

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

Kingspan Insulation has a long–term commitment to sustainability and responsibility, aiming to adopt and apply best practice sustainability principles by considering environmental, social and economic factors in all operations. Full details of how Kingspan Insulation implements these commitments can be found at www.kingspaninsulation.co.uk/sustainability.

Kingspan Insulation considers it a matter of social responsibility to be open and honest about the environmental impact of the manufacture of its products, and a full Environmental Profile based on Life Cycle Analysis (LCA) is the preferred tool to achieve this. The majority of Kingspan Insulation's **Kool**therm® and **Therma**™ products have been assigned a Green Guide rating of A+ or A, and the latest certified results are available on the Kingspan Insulation website.

A key area of sustainability reporting is the raw material supply chains, which can have an all–too–easy–to–ignore impact on a business' sustainability performance. The ultimate goal is to source raw materials responsibly. To ensure this all **Kool**therm®, **Kool**Duct® and **Therma**™ insulation products and cavity closers manufactured at Kingspan Insulation's Pembridge and Sherburn–in–Elmet manufacturing facilities are certified to BES 6001 (Framework Standard for the Responsible Sourcing of Construction Products) 'Excellent'. All **TEK**® and OPTIM-R® insulation products manufactured at Kingspan Insulation's Pembridge and Sherburn–in–Elmet manufacturing facilities are certified to BES 6001 (Framework Standard for the Responsible Sourcing of Construction Products) 'Very Good'. The products are also manufactured under a management system certified to ISO 9001: 2008, ISO 14001: 2004, BS OHSAS 18001: 2007 and ISO 50001: 2011.

Product Range

Kingspan OPTIM-R®

- Optimum performance next generation insulation solution.
- Declared (aged) thermal conductivity of 0.007 W/m·K.
- Provides an insulating performance that is up to five times better than commonly used insulation materials.
- High levels of thermal efficiency with minimal thickness.
- Ideal for constructions where depth or space for insulation is limited.
- Available in a range of sizes and thicknesses.
- Suitable for use in a variety of OEM applications.
- The first Vacuum Insulation Panel (VIP) in the world to gain a BDA Agrément®.

Kingspan **Kool**therm® K–range Products

- With a fibre–free rigid thermoset phenolic core and a thermal conductivity of 0.018 – 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.
- 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 **Therma**™ Range Products

- With a fibre–free rigid thermoset PIR insulation core and a thermal conductivity of 0.022 – 0.028 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 **Styro**zone® Range Products

- Fibre–free 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

- Unaffected by air infiltration – a problem that can be experienced with mineral fibre and which can reduce thermal performance.
- Safe and easy to install.
- If installed correctly, can provide reliable long-term thermal performance over the lifetime of the building.

Building Regulations / Standards

England & Wales

The 2013 Editions of Approved Documents L to the Building Regulations 2010 for England came into effect on April 6, 2014 and all plans submitted for Building Control approval need to comply with these new requirements.

The 2014 Editions of Approved Documents L to the Building Regulations 2010 for Wales came into effect on July 31, 2014 and all plans submitted for Building Control approval need to comply with these new requirements.

New Buildings (ADL1A & ADL2A)

The main requirement of Approved Documents L1A and L2A, for both England & Wales, is that buildings meet defined CO_2 emissions targets. For England only, there is also a requirement to meet a fabric energy efficiency requirement for ADL1A. For Wales, more stringent limiting fabric targets are instead set. The roof, wall and floor U–values required will depend on the design of the building, orientation, heating system etc. To ease the process, Kingspan Insulation has undertaken analysis to give the 'best starting point' U–values, for specifiers to work from in getting their designs to comply. They will be almost exactly what is required for some buildings and short of what is required for others. These 'best starting point' U–values are shown below.

Existing Buildings (ADL1B & ADL2B)

Approved Documents L1B and L2B, for both England & Wales, give specific U–value requirements for newly constructed elements and retained / refurbished elements. They apply to all works, regardless of whether the works relate to an extension, conversion or renovation. These suggested U–values are shown below.

Suggested / Required U–values ($W/m^2 \cdot K$) for Different Elements in Various Scenarios

Element	**New Buildings** Best Starting Point		**Existing Buildings** Extension, Conversion & Renovation Of All Buildings		
	Dwellings	Buildings Other Than Dwellings	New Elements England	New Elements Wales	Refurbishment / Retained Elements
Lofts	0.11	0.14	0.16	0.15[1] / 0.15[2]	0.16
All other roofs	0.11	0.14	0.18	0.15[1] / 0.18[2]	0.18
Walls	0.16	0.22	0.28	0.21[1] / 0.26[2]	0.55[3] / 0.30[4]
Floors	0.11	0.18	0.22	0.18[1] / 0.22[2]	0.25

1 Buildings essentially domestic in character e.g. student accommodation, care homes, and similar uses where occupancy levels and internal gains are essentially domestic in character
2 All other non–domestic buildings
3 Cavity insulation
4 External / internal insulation

Visit www.kingspaninsulation.co.uk for further information

Scotland

The new 2015 Editions of Technical Handbooks: Section 6 to the Building Regulations 2011 came into effect on October 1, 2015.

New Buildings

The main requirement of Technical Handbooks: Sections 6 is that buildings meet a defined CO_2 emissions target. For domestic, this target is generated by a set of notional buildings, which also offer a simplified elemental approach to compliance. If a building is constructed in accordance with the parameter values that define the notional building, then it will automatically comply with the CO_2 emissions target. 'Best starting point' U–values for roofs, walls and floors are shown below. For non–domestic, the approach is the same as that described above for ADL2A and `best starting point' U–values are shown below.

Existing Buildings

Technical Handbooks Sections 6 give specific area–weighted average U–value requirements for newly constructed elements and altered / refurbished elements. They apply to most works*, regardless of whether the works relate to an extension, renovation, or conversion e.g. of a whole unheated building, loft or garage. For existing dwellings, there are differing requirements for newly constructed elements, depending upon the thermal efficiency of the existing building*. The required U–values are shown below.

Suggested / Required U–values (W/m²·K) for Different Elements in Various Scenarios						
Element	**New Buildings** Best Starting Point		**Existing Buildings**			
	Domestic	Non–Domestic	Refurbishment & Extensions			Conversion of Heated Buildings
			Domestic*		Non–Domestic	
			A	B		
Lofts	0.10	0.14	0.11	0.15	0.15	0.25
All other roofs	0.10	0.14	0.13	0.18	0.15	0.25
Walls	0.15	0.18	0.17	0.22	0.25	0.30
Floors	0.13	0.15	0.15	0.18	0.20	0.25

**Column A is for extensions where the existing dwelling's walls and roof U–values are worse than 0.70 W/m²·K in the walls and worse than 0.25 W/m²·K in the ceiling. Column B is for other extensions, upgraded existing thermal elements, non–exempt conservatories and conversion of unheated buildings.*

Warm Flat Roofing

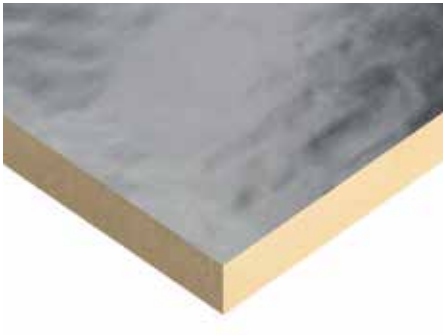
MECHANICALLY FIXED SINGLE-PLY WATERPROOFING

Kingspan **Therma**roof® TR26 LPC/FM

Kingspan **Therma**roof® TR26 LPC/FM has a rigid thermoset polyisocyanurate (PIR) insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Therma**roof® TR26 LPC/FM is suitable for use:

- with most mechanically fixed single–ply waterproofing systems (including FM Approved systems);
- with metal waterproofing systems; and
- in most green roof systems.



Fibre-free Core

Product details:

- Thermal Conductivity – 0.022 W/m·K
- Compressive Strength – typically exceeds 150 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 2.4 m
- Thicknesses – 25 – 160 mm (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A+

Product benefits:

- Ideal for fast track building programmes and under green roofs
- LPCB approved to LPS 1181: Part 1*
- FM approved for Class 1 steel deck roof assemblies*
- Fibre–free core
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

** Refer to full product literature for construction build-ups.*

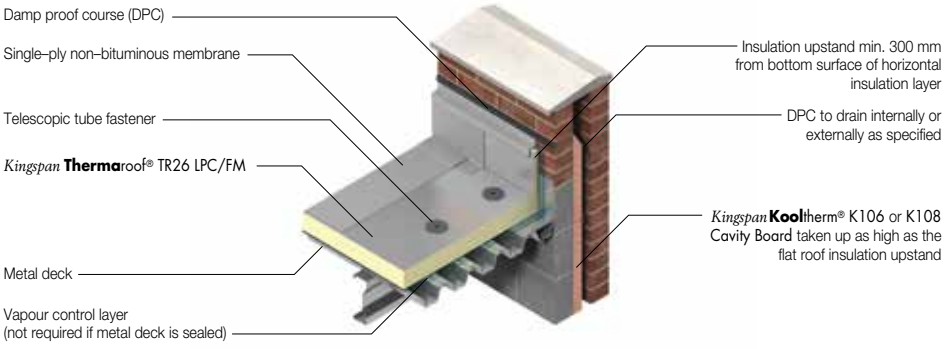
Installation Details

- Deck should be clean, dry, without large projections or steps 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.
- For other deck types, 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* **Therma**roof® TR26 LPC/FM should be secured to the deck using mechanical fixings e.g. telescopic tube fasteners.
- Insulation boards should always be laid break–bonded, either with their long edges at right angles to the trough openings / edge of roof, or diagonally across the corrugation line / 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* **Therma**roof® TR26 LPC/FM as the general roof area.
- A 25 mm thick *Kingspan* **Therma**roof® TR26 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.
- For further installation details for specific deck types, please visit www.kingspaninsulation.co.uk/tr26 to download the full product literature.

⚠ *Do not stand on or otherwise support your weight on this board unless it is fully supported by a load bearing surface.*

Warm Flat Roofing
MECHANICALLY FIXED SINGLE-PLY WATERPROOFING

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.10	0.11	0.14	0.15	0.16	0.18	0.25
Single ply membrane	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Kingspan **Therma**roof® TR26 LPC/FM	110 + 100	100 + 90	80 + 80	140	135	120	85
Vapour control layer	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Metal deck	50	50	50	50	50	50	50

NB Speak to your local merchant or distributor for stocked board thicknesses.

Warm Flat Roofing

FULLY ADHERED SINGLE-PLY, PARTIALLY BONDED BUILT-UP FELT, MASTIC ASPHALT & COLD LIQUID-APPLIED WATERPROOFING

Kingspan **Therma**roof® TR27 LPC/FM

Kingspan **Therma**roof® TR27 LPC/FM has a rigid thermoset polyisocyanurate (PIR) insulation core faced on both sides with a coated glass tissue facing.

Kingspan **Therma**roof® TR27 LPC/FM is suitable for use:

- in most fully adhered single-ply waterproofing systems;
- in most green roof systems;
- in partially bonded built up felt and mastic asphalt waterproofing systems;
- warm roof applications over roof decks up to 10° pitch when used in conjunction with a separate bituminous vapour control layer; and
- cold liquid applied waterproofing systems.

Fibre-free Core

Product details:

- Thermal Conductivity –
  - 0.026 W/m·K (insulant thickness < 80 mm)
  - 0.025 W/m·K (insulant thickness 80–119 mm)
  - 0.024 W/m·K (insulant thickness ≥ 120 mm)
- Compressive Strength – typically exceeds 150 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 2.4 m and 1.2 m x 0.6 m
- Thicknesses – 50 – 160 mm (1.2 x 2.4 m boards)
  25 – 140 mm (1.2 x 0.6 m boards)
  (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A

Product benefits:

- Ideal for fast track building programmes and under green roofs
- LPCB approved to LPS 1181: Part 1*
- FM approved for Class 1 steel deck roof assemblies*
- Fibre–free core
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

** Refer to full product literature for construction build-ups.*

Warm Flat Roofing

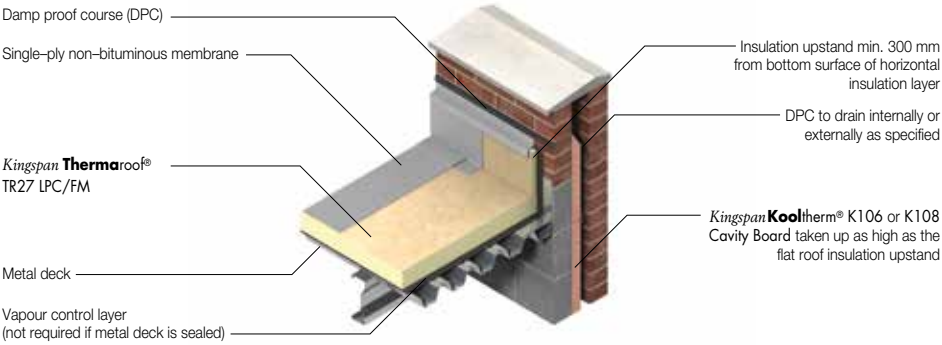
FULLY ADHERED SINGLE-PLY, PARTIALLY BONDED BUILT-UP FELT, MASTIC ASPHALT & COLD LIQUID-APPLIED WATERPROOFING

Installation Details

- Deck should be clean, dry, without large projections or steps 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.
- For other decks, if the insulation boards are to be bonded down, in order to ensure an adequate bond between the deck and the vapour control layer, the 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.
- 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 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 / edge of roof, or diagonally across the corrugation line / roof and with joints lightly butted. There should be no gaps at abutments.
- Roof–light or ventilator kerbs etc. should always insulated with the same thickness of *Kingspan* **Therma**roof® TR27 LPC/FM as the general roof area.
- A 25 mm thick *Kingspan* **Therma**roof® 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.
- For further installation details for specific deck types, please visit www.kingspaninsulation.co.uk/tr27 to download the full product literature.

⚠ *Do not stand on or otherwise support your weight on this board unless it is fully supported by a load bearing surface.*

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.10	0.11	0.14	0.15	0.16	0.18	0.25
Single ply membrane	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Kingspan **Therma**roof® TR27 LPC/FM	120 + 110	110 + 110	90 + 80	80 + 80	80 + 70	130	95
Vapour control layer	3	3	3	3	3	3	3
Metal deck	50	50	50	50	50	50	50

NB Speak to your local merchant or distributor for stocked board thicknesses.

Warm Flat Roofing

FULLY ADHERED SINGLE-PLY, PARTIALLY BONDED BUILT-UP FELT, MASTIC ASPHALT & COLD LIQUID-APPLIED WATERPROOFING

Kingspan Thermaroof TR26 & TR27 LPC/FM Fixing Patterns

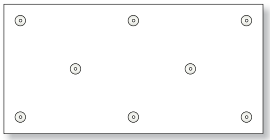
The recommended fixing patterns for *Kingspan* **Therma**roof® TR26 LPC/FM and *Kingspan* **Therma**roof® TR27 LPC/FM are shown below. The number of mechanical fixings required to fix the boards will vary with the geographical location of the building, the local topography and the height and width of the roof concerned, along with the deck type.

The images below show a selection of recommended fixing patterns, the number of fixings used and the resulting fixing density (number of fixings per m^2). For further fixing patterns please see the full literature.

Kingspan **Therma**roof® TR26 LPC/FM

6 No. per board
(2.4 x 1.2 m board – 2.08 fixings / m^2)

7 No. per board
(2.4 x 1.2 m board – 2.43 fixings / m^2)



8 No. per board
(2.4 x 1.2 m board – 2.77 fixings / m^2)

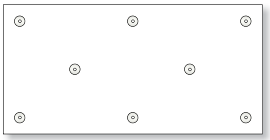
Kingspan **Therma**roof® TR27 LPC/FM

4 No. per board
(1.2 x 0.6 m board – 5.55 fixings / m^2)

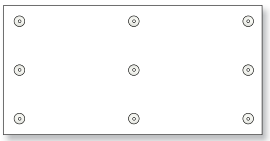
5 No. per board
(1.2 x 0.6 m board – 6.94 fixings / m^2)
(1.2 x 1.2 m board – 3.47 fixings / m^2)

6 No. per board
(1.2 x 0.6 m board – 8.33 fixings / m^2)
(1.2 x 1.2 m board – 4.16 fixings / m^2)
(2.4 x 1.2 m board – 2.08 fixings / m^2)

7 No. per board
(1.2 x 0.6 m board – 9.72 fixings / m^2)
(1.2 x 1.2 m board – 4.86 fixings / m^2)
(2.4 x 1.2 m board – 2.43 fixings / m^2)



8 No. per board
(1.2 x 0.6 m board – 11.11 fixings / m^2)
(1.2 x 1.2 m board – 5.55 fixings / m^2)
(2.4 x 1.2 m board – 2.77 fixings / m^2)



9 No. per board
(1.2 x 0.6 m board – 12.50 fixings / m^2)
(1.2 x 1.2 m board – 6.25 fixings / m^2)
(2.4 x 1.2 m board – 3.12 fixings / m^2)

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.

A minimum of 4 fixings are required to secure a 1.2 m x 0.6 m insulation board to the deck, a minimum of 5 fixings are required to secure a 1.2 x 1.2 m insulation board to the deck and a minimum of 6 fixings are required to secure a 2.4 x 1.2 m insulation board to the deck. The requirement for additional fixings should be assessed in accordance with BS 6339-2: 1997 (Loadings for buildings. Code of practice for wind loads) or BS / IS. EN 1991. 9.4.2005 (National annex to Eurocode 1. Actions on structures, general actions, wind actions)

Pitched Roofs

INSULATION AT RAFTER LEVEL – CHOICE OF BUILD-UP

Unventilated and Ventilated Constructions

There is generally a choice between unventilated and ventilated constructions, except in the case of refurbishment / loft conversions. In these instances, unless the whole roof is to be stripped or unless there is a breathable sarking membrane already in situ, it is impossible to use an unventilated roof, because a breathable sarking membrane cannot be installed.

Position of Insulation

Dependent on the designed U–value of the construction and the available rafter depth and headroom, different approaches can be taken.

In most cases, approaches with layers of insulation between and over rafters are likely to yield very tall fascia boards and so, generally, between and under rafter insulation approaches are probably more desirable. The exception to the rule is when very low U–values are required, in which case headroom may become an issue for between and under rafter solutions, so between and over rafter solutions may be more practical.

Unventilated Roof – Ventilation Considerations

Unventilated roof approaches create a warm pitched roof space which does not require cross ventilation. Research suggests that sealing an unventilated roof yields a more energy efficient roof, as the impacts of ventilation and incidental infiltrating cold air can be minimised. Therefore, if creating an unventilated roof, it is preferable to fully seal all joints in the breathable sarking membrane. Any water vapour reaching the breathable sarking membrane escapes without condensing. There is then adequate air movement beneath the tiles to dissipate this water vapour to the outside atmosphere. Tape for sealing joints in the breathable sarking membrane should be specified in accordance with the recommendations of the breathable membrane manufacturer.

The requirement for a vapour control layer and / or under–tile ventilation should be assessed to BS 5250: 2011 (Code of practice for control of condensation in buildings).

Ventilated Roof – Ventilation Considerations

In these cases the Building Regulations / Standards require a 50 mm ventilation air gap between the insulation and the sarking felt, so as to avoid condensation.

The requirement for a vapour control layer should be assessed to BS 5250: 2011.

Vapour Control Layer

If required, the vapour resistance of the roof lining can be increased by the use of a vapour check plasterboard*, the use of *Kingspan* **Kool**therm® K118 Insulated Plasterboard, which contains an integral vapour control layer*, the use of a layer of polythene sheeting*, or by the application of two coats of Gyproc Drywall Sealer.

** With appropriate detailing at joints, penetrations and roof perimeters.*

Pitched Roofs

INSULATION AT RAFTER LEVEL – CHOICE OF BUILD-UP

Breathable Sarking Membrane

BS 5250: 2002 recommends that low resistance breathable sarking membranes for use in unventilated systems must not have a vapour resistance that exceeds 0.25 MN.s/g, e.g. *Kingspan* **nilvent**®.

Position of Breathable Sarking Membrane

The sealing of breathable sarking membrane joints with tape is considerably easier to achieve if the membrane is installed on a continuous surface.

In these cases the breathable sarking membrane is installed over or under the counter–battens (which provide a channel for water drainage) or, in situations with a sarking board under a natural slated roof, the breathable sarking membrane is installed directly under the slates (as neither tile battens nor counter–battens are used).

Generally, when a continuous surface is available, it will prove easier to install the breathable sarking membrane in horizontal runs, whilst still enabling easy sealing between runs.

In roofs with no continuous surface, it is preferable, though more difficult, to install the breathable sarking membrane in vertical runs with junctions between runs sealed by counter–battens placed over the laps in rafter positions. The breathable sarking membrane is installed taut as the counter–batten provides a space for water drainage.

Recommended Solutions for New Build / Re-roofing

The ideal solution for new build or re–roofing projects is, therefore, between and under rafter insulation with a continuous surface for the breathable sarking membrane so that it can be installed in horizontal runs under counter–battens with laps sealed with tape.

The next best solution is, therefore, insulation with no continuous surface for the breathable sarking membrane, and the breathable sarking membrane installed in vertical runs with laps sealed under counter–battens.

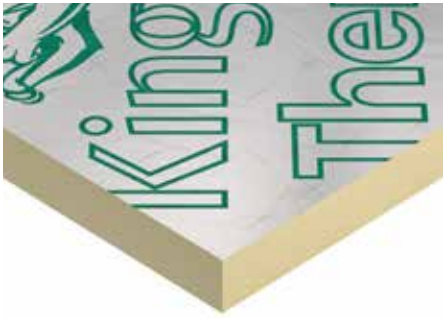
Pitched Roofs
VENTILATED & UNVENTILATED

Kingspan **Therma**pitch® TP10

Kingspan **Therma**pitch® TP10 has a rigid thermoset polyisocyanurate (PIR) insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Therma**pitch® TP10 is suitable for use:

- as rafter level insulation, or between ceiling joists for tiled or slated pitched warm roof spaces;
- in roof voids; and
- in cold flat and cold pitched roofs.



Fibre-free Core

Product details:

- Thermal Conductivity – 0.022 W/m·K
- Compressive Strength – typically exceeds 140 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 2.4 m
- Thicknesses – 20 – 160 mm (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A+

Product benefits:

- Easy to handle and install
- Fibre–free core
- Ideal for new build and refurbishment
- Can be used as detailed in Robust Details for Part E of the Building Regulations (England and Wales)
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details – Full Fill Between & Under Rafter Insulation (Unventilated)

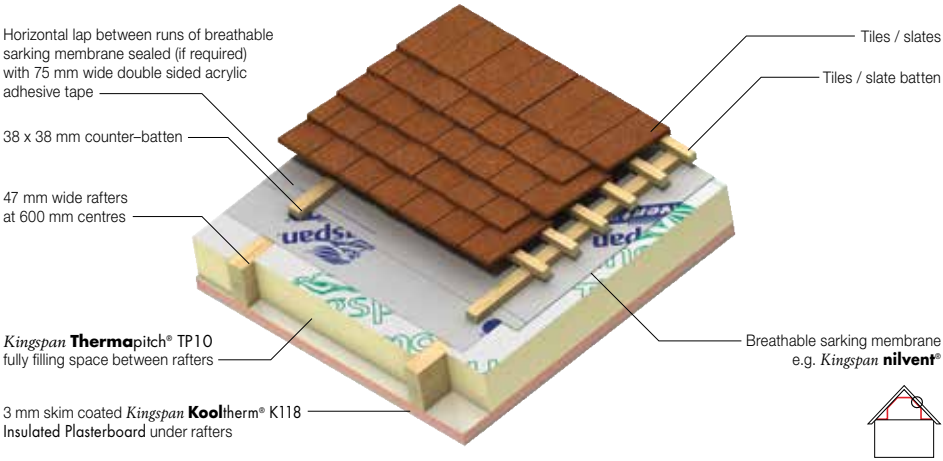
Between Rafters

- Where the insulation between rafters fully fills the rafter depth, simply install the correct thickness of insulation, trimmed to suit rafter spacings, in such a manner that it is flush with the bottom and top of the rafters.
- If the between rafter insulation is to be fitted from the outside, install the insulation with the use of timber 'stop' battens.
- Timber 'stop' battens should be the correct size so the insulation is flush with the top surfaces of the rafters.
- The timber 'stop' battens are driven into the upper surface of each rafter at one–metre intervals up the roof slope.
- The timber 'stop' battens then support lengths of insulation, trimmed to suit rafter spacings, and placed between the rafters.

Under Rafters

- Sheets of *Kingspan* **Kool**therm® K118 Insulated Plasterboard must always be placed with the long edge running across the joists or rafters, and all edges must be supported.
- Where joints between sheets of insulated plasterboard are unsupported by the timber joists / rafters, timber noggins should be installed.
- Each sheet of insulated plasterboard should lap joists / rafters / noggins by 19 mm (min.) at sheet joints.
- Sheets should be fixed using either drywall screws at 230 mm centres, or large–headed galvanised clout nails placed at 150 mm centres.
- Fixings should be located no less than 10 mm from the edges of the sheet, and be long enough to allow a minimum 25 mm penetration of the timber.
- Fixings should be driven straight, with the head embedded just below the surface of the plasterboard.
- Care should be taken not to overdrive nails / screws.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)					
	U–values					
	0.10	0.11	0.14	0.15	0.16	0.25
Plaster skim	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	87.5	72.5	72.5	62.5	57.5	n/a*
Kingspan **Therma**pitch® TP10 (full fill) between rafters	150	150	100	100	100	120
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5
Counter–batten	38	38	38	38	38	38
Tiles / slates on battens	30	30	30	30	30	30

Calculations assume rafters at 600 mm centres. Rafter depth is to suit thickness of insulation.
**Standard plasterboard & vapour control layer.*
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Partial Fill Between & Under Rafter Insulation (Unventilated)

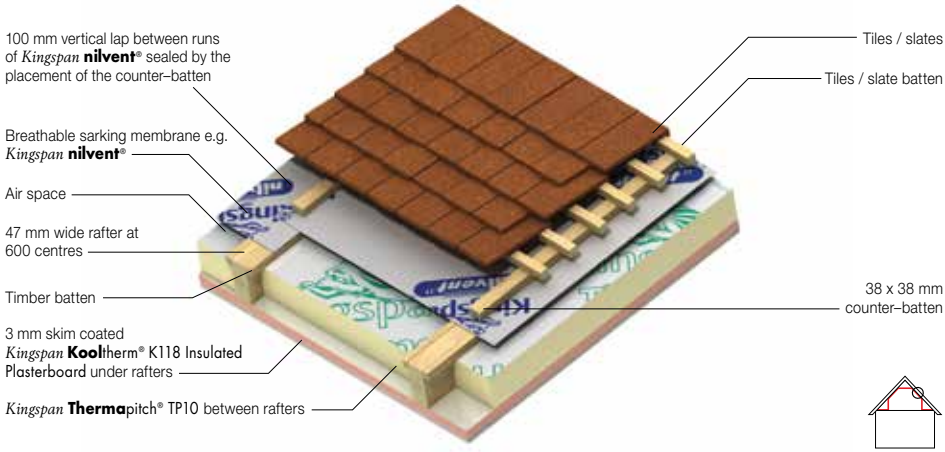
Between Rafters

- *Kingspan* **Therma**pitch® TP10 installed between rafters must be flush with the bottom of the rafters in order to prevent the risk of air movement between the board and the ceiling.
- Install the insulation, trimmed to suit rafter spacings, with the aid of treated softwood battens nailed to the side of the rafters to provide a 'stop' above the insulation.
- The battens should be in the appropriate position to ensure the insulation is flush with the bottom of the rafters.
- An additional restraint to the insulation boards will be provided by *Kingspan* **Kool**therm® K118 Insulated Plasterboard fixed to the inside face of the rafters.

To Timber Joists or Rafters

- Sheets of *Kingspan* **Kool**therm® K118 Insulated Plasterboard may be used to line ceilings.
- Sheets must always be placed with the long edge running across the joists or rafters, and all edges must be supported.
- Where joints between sheets of insulated plasterboard are unsupported by the timber joists / rafters, timber noggins should be installed.
- Each sheet of insulated plasterboard should lap joists / rafters / noggins by 19 mm (min.) at sheet joints.
- Sheets should be fixed using either drywall screws at 230 mm centres, or large–headed galvanized clout nails placed at 150 mm centres.
- Each sheet of insulated plasterboard should be lightly butted, with fixings located no less than 10 mm from the bound edges of the sheet. Fixings should be long enough to allow a minimum 25 mm penetration of the timber.
- Fixings should be driven straight, with the heads embedded just below the surface of the plasterboard.
- Care should be taken not to overdrive nails / screws.
- The perimeter of the *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be sealed with a flexible sealant or equivalent.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)					
	U–values					
	0.10	0.11	0.14	0.15	0.16	0.25
Plaster skim	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard under timber rafters	87.5	82.5	52.5	42.5	32.5	n/a*
Kingspan **Therma**pitch® TP10 between timber rafters	150	120	125	125	125	100
Timber rafter cavity	0	30	25	25	25	50
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5
Counter–batten cavity	38	38	38	38	38	38
Tiles / slates on battens	30	30	30	30	30	30

Calculations assume 150 mm deep rafters at 600 mm centres.
**Standard plasterboard & vapour control layer.*
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Between & Over Rafter Insulation (Unventilated)

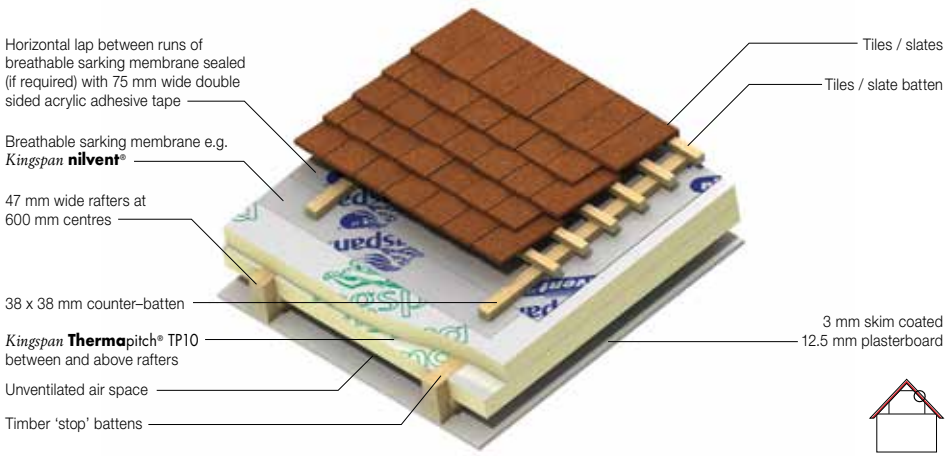
Between Rafters

- If *Kingspan* **Therma**pitch® TP10 is to be installed between and over rafters, the between rafter layer must be flush with the top of the rafters in order to prevent the risk of air movement between the two layers of insulation boards.
- If the between rafter insulation is to be fitted from the outside, install the insulation with the use of timber 'stop' battens.
- The timber 'stop' battens should be the correct size so the insulation is flush with the top surface of the rafters.
- The timber 'stop' battens are driven into the upper surface of each rafter at one–metre intervals up the roof slope.
- The timber 'stop' battens then support lengths of insulation, trimmed to suit rafter spacings, and placed between the rafters.
- Insulation can be installed from the inside with the use of timber 'stop' battens.
- Push insulation, trimmed to suit rafter spacings, between the rafters so they are flush with the top surface of the rafters.
- Side–treated softwood battens should be nailed to the rafters to hold the boards in place.

Over Rafters

- A preservative treated 'stop' rail should be secured to the rafters at the eaves.
- *Kingspan* **Therma**pitch® TP10 may be laid either across or down the line of the rafters and should be laid lightly butted and preferably break bonded.
- All board joints running from eaves to ridge must occur over rafters.
- Ensure continuity of insulation at the ridge of the roof.
- There is no necessity to tape board joints.
- If there is no sarking board, lay 38 x 38 mm treated softwood counter–battens in line with the rafters and secure these by fixing through both the counter–battens and the insulation boards.
- If a sarking board is overlaid, secure the sarking board and insulation boards to the rafters by fixing through both the sarking board and the insulation.
- Approved fixings should be applied at centres appropriate to the design of the roof and location of the building.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)					
	U–values					
	0.10	0.11	0.14	0.15	0.16	0.25
Plaster skim	3	3	3	3	3	3
Plasterboard	12.5	12.5	12.5	12.5	12.5	12.5
Vapour control layer	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan **Therma**pitch® TP10 between timber rafters	100	100	75	70	60	40
Kingspan **Therma**pitch® TP10 fixed above rafters	140	110	80	75	70	40
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5
Counter–batten cavity	38	38	38	38	38	38
Tiles / slates on battens	30	30	30	30	30	30

Calculations assume 100 mm rafters at 600 mm centres.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Dwarf Wall Insulation (Ventilated & Unventilated)

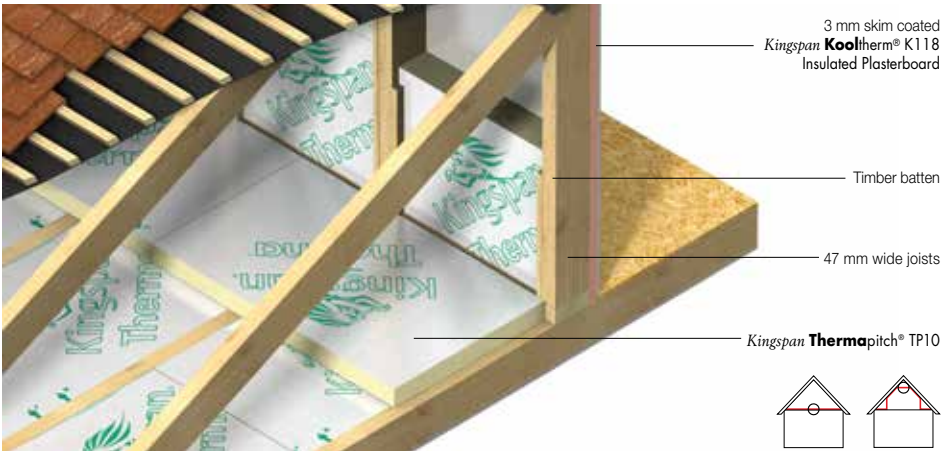
Between Dwarf Wall Stud Insulation

- *Kingspan* **Therma**pitch® TP10 installed between studs must be flush with the inside surface of the studs and the plasterboard / insulated plasterboard wall finish in order to prevent the risk of air movement between the boards and the plasterboard / insulated plasterboard.
- Treated softwood battens should be nailed to the side of the studs to provide a 'stop' and prevent the insulation boards moving within the stud cavity.
- This 'stop' should be positioned such that the insulation boards finish flush with the inside surface of the studs.
- If the insulation boards are thicker than the timber studs, fix appropriately sized treated softwood battens to the back of the studs and fix timber 'stop' straps diagonally to the battens in an appropriate pattern to hold the insulation boards in place. Each board must be restrained by a minimum of two diagonal straps.
- Insulation boards may be temporarily held in place with large headed clout nails fixed through the 'stop' battens / straps.
- The boards will be further restrained by the plasterboard / insulated plasterboard lining fixed to the inside face of the timbers.

Inside Dwarf Wall Studs Insulation

- Please see fixing details on page 34.

Typical Construction & U-values



Ventilated

Item	Thickness (mm) of material to achieve U–values (W/m²·K)										
	U–values										
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30	0.55
Plaster skim	3	3	3	3	3	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	52.5	32.5	32.5	32.5	32.5	32.5	32.5	n/a*	n/a*	n/a*	n/a*
Kingspan **Therma**pitch® TP10 between timber studs	125	150	140	130	100	95	75	120	110	100	45
Ventilated loft void	300	300	300	300	300	300	300	300	300	300	300
Sarking felt	2	2	2	2	2	2	2	2	2	2	2
Tiles / slates on battens	30	30	30	30	30	30	30	30	30	30	30

Stud depth to suit thickness of insulation. Bridging effect of the studs has been taken to be 15%.
**Standard plasterboard & vapour control layer.*
NB Speak to your local merchant or distributor for stocked board thicknesses.

Unventilated

Item	Thickness (mm) of material to achieve U–values (W/m²·K)										
	U–values										
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30	0.55
Plaster skim	3	3	3	3	3	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	32.5	32.5	32.5	32.5	32.5	32.5	32.5	n/a*	n/a*	n/a*	n/a*
Kingspan **Therma**pitch® TP10 between timber studs	150	140	125	115	90	85	70	100	90	85	35
Unventilated loft void	300	300	300	300	300	300	300	300	300	300	300
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tiles / slates on battens	30	30	30	30	30	30	30	30	30	30	30

Stud depth to suit thickness of insulation. Bridging effect of the studs has been taken to be 15%.
**Standard plasterboard & vapour control layer.*
NB Speak to your local merchant or distributor for stocked board thicknesses.

Visit www.kingspaninsulation.co.uk for further information

Installation Details – Partial Fill Between & Under Rafter Insulation (Ventilated)

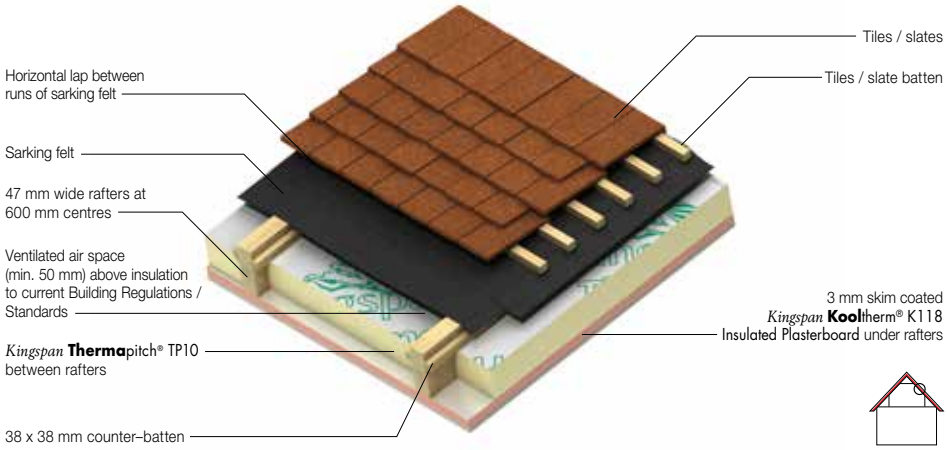
Between Rafters

- *Kingspan* **Therma**pitch® TP10 installed between rafters must be flush with the bottom of the rafters in order to prevent the risk of air movement between the board and the ceiling.
- Install the insulation, trimmed to suit rafter spacings, with the aid of treated softwood battens nailed to the side of the rafters to provide a 'stop' above the insulation.
- The battens should be in the appropriate position to ensure the insulation is flush with the bottom of the rafters.
- An additional restraint to the insulation boards will be provided by *Kingspan* **Kool**therm® K118 Insulated Plasterboard fixed to the inside face of the rafters.

To Timber Joists or Rafters

- Sheets of *Kingspan* **Kool**therm® K118 Insulated Plasterboard may be used to line ceilings.
- Sheets must always be placed with the long edge running across the joists or rafters, and all edges must be supported.
- Where joints between sheets of insulated plasterboard are unsupported by the timber joists / rafters, timber noggins should be installed.
- Each sheet of insulated plasterboard should lap joists / rafters / noggins by 19 mm (min.) at sheet joints.
- Sheets should be fixed using either drywall screws at 230 mm centres, or large–headed galvanized clout nails placed at 150 mm centres.
- Each sheet of insulated plasterboard should be lightly butted, with fixings located no less than 10 mm from the bound edges of the sheet. Fixings should be long enough to allow a minimum 25 mm penetration of the timber.
- Fixings should be driven straight, with the heads embedded just below the surface of the plasterboard.
- Care should be taken not to overdrive nails / screws.
- The perimeter of the *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be sealed with a flexible sealant or equivalent.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)			
	0.14	0.15	0.16	0.25
Plaster skim	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	72.5	62.5	52.5	32.5
Kingspan **Therma**pitch® TP10 between timber rafters	90	100	100	65
Ventilated rafter cavity	60	50	50	85
Sarking felt	2	2	2	2
Tiles / slates on battens	30	30	30	30

Calculations assume 150 mm rafters at 600 mm centres.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Masonry Walls

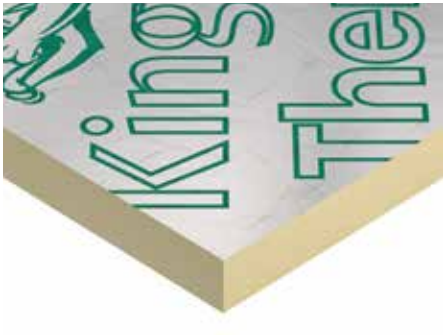
PARTIAL FILL CAVITY INSULATION

Kingspan **Therma**wall® TW50

Kingspan **Therma**wall® TW50 has a rigid thermoset polyisocyanurate (PIR) insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Therma**wall® TW50 is suitable for use:

- as partial fill insulation in cavity walls.



Product details:

- Thermal Conductivity – 0.022 W/m·K
- Compressive Strength – typically exceeds 125 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 0.45 m
- Thicknesses – 25 – 100 mm (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A+

Product benefits:

- Resists water penetration by allowing a clear cavity to be maintained
- Low emissivity foil facings significantly increase the thermal performance of the cavity
- Meets NHBC technical requirements when used with a 50 mm residual cavity
- Easy to handle and install
- Boards are designed to fit easily with standard brick and block dimensions
- Board sizes allow the insertion of wall ties at appropriate spacing
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

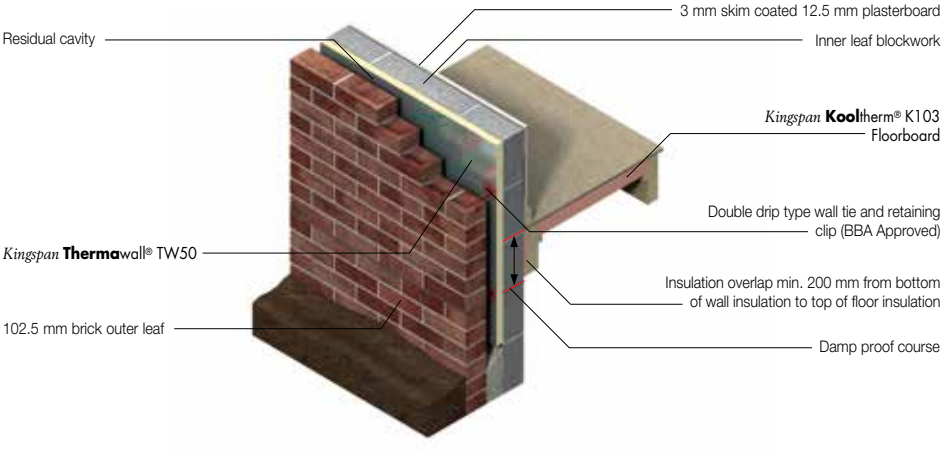
Installation Details

Cavity Insulation

- *Kingspan* **Therma**wall® TW50 is normally held in position by the wall ties used to tie the two skins of masonry together.
- Wall ties should include a retaining disc / clip and be of the double drip type, installed drip downward.
- For solid concrete ground floors, the first row of wall ties are installed in the inner leaf at 600 mm horizontal centres a minimum of one course of blockwork below the damp proof course or 150 mm below the top surface of the ground floor perimeter insulation upstand, whichever is the lower.
- For a suspended timber floor the first row of wall ties are installed in the inner leaf at 600 mm horizontal centres a minimum of 200 mm below the top surface of the ground floor perimeter insulation upstand.
- Continue constructing the inner leaf up to the next wall tie course (450 mm above the first – usually 2 block courses).
- The next course of wall ties is positioned at the usual 900 mm horizontal centres.
- The next course of blockwork is installed to secure the ties.
- The first row of insulation boards should now be installed between the two rows of wall ties, ensuring each insulation board is retained tight against the inner leaf and joints are lightly butted.
- Each board should be secured at a minimum of three points. Additional ties may also be required to satisfy the structural requirements of BS EN 845-1: 2013, BS EN 1996-1-3: 2005, PD 6697: 2010 and / or to ensure adequate retention of boards or cut pieces.
- The outer leaf is then built up to the level of the top of the boards and the process is repeated.
- When insulating a gable, insulation boards should be continued 250 mm beyond the height of the top storey ceiling and a cavity tray installed above the insulation.

Masonry Walls
PARTIAL FILL CAVITY INSULATION

Typical Construction & U-values

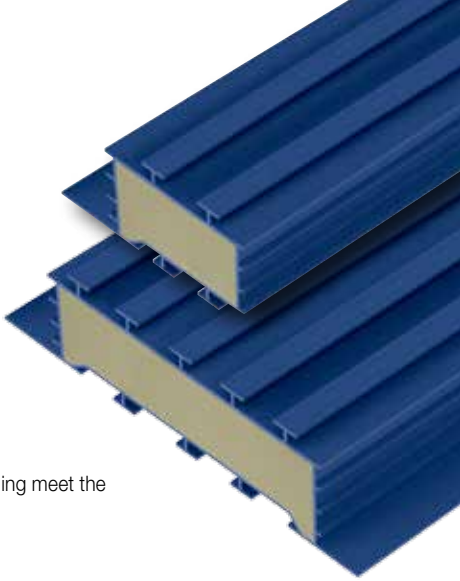


Item	Thickness (mm) of material to achieve U–values (W/m²·K)									
	U–values									
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30
Plaster skim	3	3	3	3	3	3	3	3	3	3
Plasterboard	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Plaster dabs cavity	15	15	15	15	15	15	15	15	15	15
Blockwork	100	100	100	100	100	100	100	100	100	100
Kingspan **Therma**wall® TW50	70 + 60	60 + 50	100	95	75	70	60	55	50	45
Cavity	50	50	50	50	50	50	50	50	50	50
Brickwork	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5

Calculations assume inner leaf brickwork of medium density (0.51 W/m·K).
NB Speak to your local merchant or distributor for stocked board thicknesses.

Masonry Walls

CAVITY CLOSER - FORMING OPENINGS



Kingspan **Therma**bate® & **Therma**bate® PLUS

Kingspan **Therma**bate® is a PVC–U extrusion with a fibre–free, rigid thermoset insulation core that maintains continuous insulation around window and door openings.

Kingspan **Therma**bate® is suitable for use with:

- timber window and door frames;
- metal window and door frames; and
- composite window and door frames where the frame and internal lining meet the requirements of acting as a cavity barrier.

Fibre-free Core

Product details:

- Thermal Conductivity – 0.034 W/m·K
- Section Length – 3.0 m
- Widths Available – 50 – 150 mm (sections can be joined to suit cavity widths up to 300 mm)

Product benefits:

- Simplified construction – avoids the need for cut bricks, blocks or special reveal blocks
- Reduces thermal bridging, condensation risk and mould growth
- Improves weather resistance by forming an integral DPC
- Can be fitted with door / window frames as a combined unit
- Easy to handle and install
- Fibre–free core
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

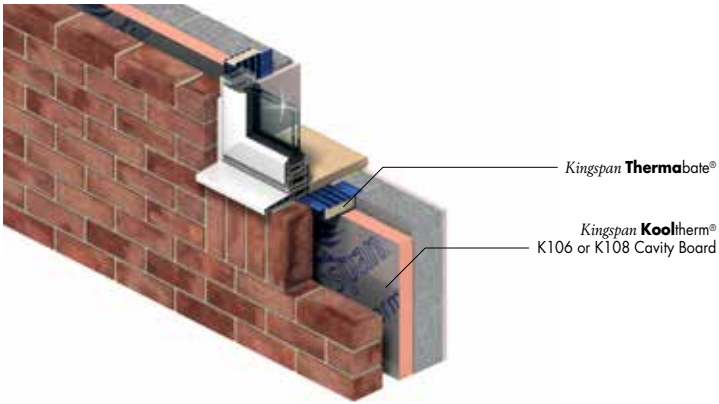
Installation Details

Basic Principles

- *Kingspan* **Therma**bate® should be built–in as the wall is being constructed, keying mortar from bed joints to the fins on the *Kingspan* **Therma**bate® casing.
- The flange (in the case of larger sections, the primary flange) can be fixed to either the inner or outer leaf of the masonry.
- To enable the frame assembly to be set further back into reveals, particularly if a check reveal is required, fix the flange to the inner leaf.
- Flange/s should always be positioned tight against the masonry and securely fixed to the masonry with a suitable fixing through the holes in the flange/s.
- Sections and frames should be fitted tight within the cavity and, ideally, no gaps should be left between them and either wall leaf.
- In the circumstance where the section, exclusive of the flange/s, does not fully fill the cavity, the appropriately sized section should span the cavity such that the residual gap, which should be no greater than 10 mm, is situated behind the flange.
- Incorporate an appropriate lintel and damp proof course at the head of the opening.
- Where an insulated lintel is used, a head section or head side of the frame is not required. Jamb sections or jamb sides of the frame are butted up against the lintel. If required, a section can be used at the head where a separate lintel is used for each leaf.

Installing Individual Sections

- Install *Kingspan* **Therma**bate® sill, jamb and head sections individually as the wall is being constructed.
- For sills, cut sections to precisely match the width of the opening.
- For jambs, cut sections such that they overhang the bottom of the sill by 50 mm, removing the flange/s as necessary in order to enable the sections to fit into the cavity under the sill edge of the opening.
- If used at the head, cut sections to extend 50 mm beyond each jamb section again, removing the flange/s as necessary.



Timber Frame Systems

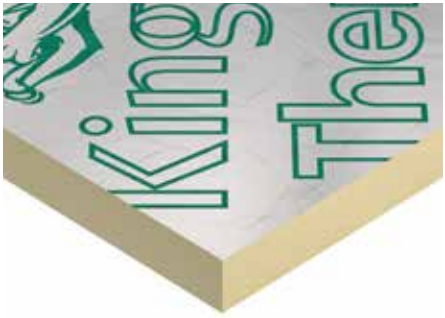
INSULATION BETWEEN STUDS WITH & WITHOUT INSULATED SHEATHING

Kingspan **Therma**wall® TW55

Kingspan **Therma**wall® TW55 has a rigid thermoset polyisocyanurate (PIR) insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Therma**wall® TW55 is suitable for use:

- in timber and steel framing systems.



Product details:

- Thermal Conductivity – 0.022 W/m·K
- Compressive Strength – typically exceeds 140 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 2.4 m
- Thicknesses – 20 – 160 mm (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A+

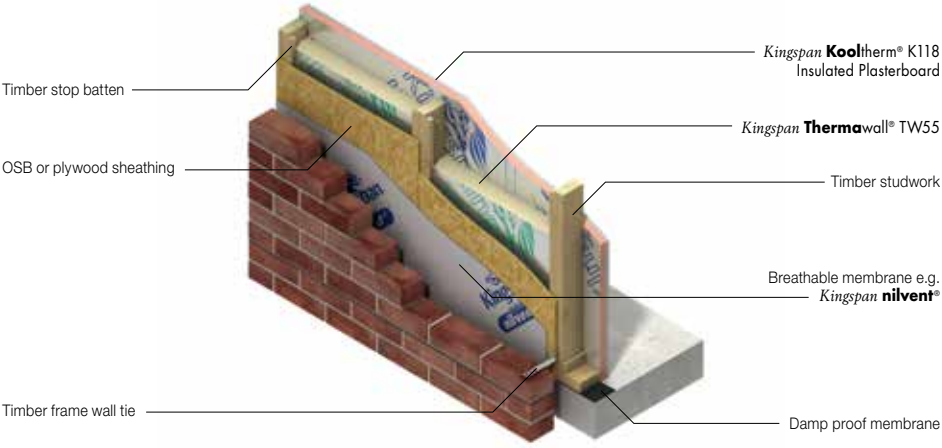
Product benefits:

- Can be used between studs or as an insulating sheathing
- Suitable for use with timber frame and steel frame wall constructions
- Easy to handle and install
- Ideal for new build or refurbishment
- Fibre–free core
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details – Insulation Between Studs

- *If the insulation boards are to be fitted so that they are flush with the inside surface of the timber studs*, treated softwood battens should be nailed to the side of the studs, to provide a 'stop' to prevent the insulation boards from moving within the stud cavity.
- This 'stop' should be positioned to allow the insulation boards to finish flush with the inside surface of the studs.
- Insulation boards may be temporarily held to the 'stop' battens with large headed clout nails.
- The boards will be further restrained by the plasterboard lining, fixed to the inside face of the studs.
- *If the insulation boards are to be fitted so that they are flush with the outside surface of the timber studs*, tight up against the pre–installed OSB or plywood sheathing, insulation boards must be cut and fitted in the spaces between the studs.
- Once the boards are fitted in place, nail treated softwood battens to the side of the studs, to provide a 'stop' to prevent the insulation boards from moving within the stud cavity.
- In all cases, measure the distance between studs before cutting *Kingspan* **Therma**wall® TW55 to size, as spacings can vary.
- Ensure there is a tight fit between the boards and adjoining studs and other timbers, and fill all gaps with expanding urethane sealant.
- Ensure that the boards are lightly butted, and continuity of insulation is maintained.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)									
	U–values									
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30
Plaster skim	3	3	3	3	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	42.5	37.5	32.5	32.5	32.5	n/a*	n/a*	n/a*	n/a*	n/a*
Kingspan **Therma**wall® TW55 between timber studs	120	120	120	100	75	120	90	85	75	65
Timber stud cavity	20	20	20	40	65	20	50	55	65	75
OSB sheathing	9	9	9	9	9	9	9	9	9	9
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cavity	50	50	50	50	50	50	50	50	50	50
Brickwork	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5

Calculations assume 140 mm timber studs with a thermal conductivity of 0.12 W/m·K and a bridging factor of 15%.
**Standard plasterboard & vapour control layer.*
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Between Studs with Insulated Sheathing

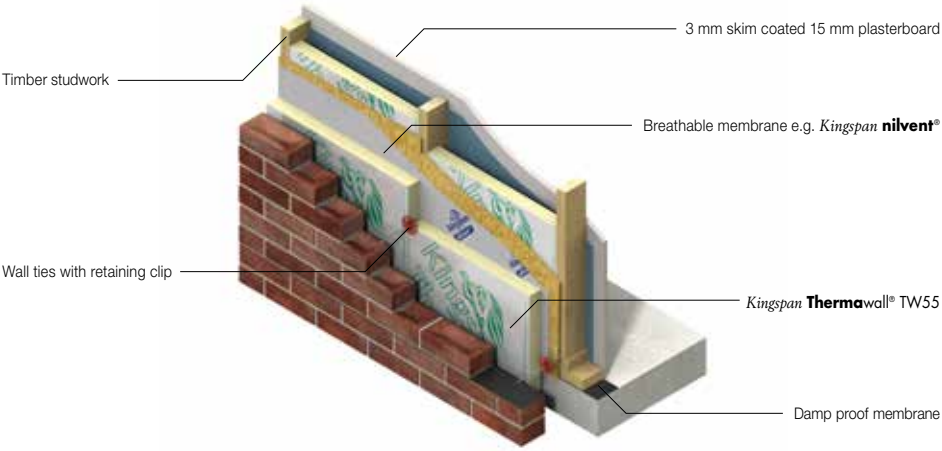
Between Studs

- Please see installation details on page 34.

Insulated Sheathing

- *Kingspan* **Therma**wall® TW55 should be fixed to the external surface of the timber or steel frame construction (outside of any breathable membrane, OSB or plywood sheeting), and restrained in accordance with the frame manufacturers recommendations. However, in the absence of any other guidance please note the following.
- Ensure the boards are lightly butted and continuity of insulation is maintained.
- Large headed galvanised clout nails may be used as temporary fixings prior to the insulation boards being tied into the masonry leaf with an appropriate timber frame wall tie.
- Always ensure that fixings are coincident with the underlying timber studs, head rails and sole plates.
- *For ventilated cladding systems*, a breathable membrane, e.g. *Kingspan* **nilvent**®, is fitted over the insulation, and temporarily stapled or pinned in place.
- Preservative treated softwood battens are fixed vertically to the wall structure, through the insulation sheathing, and breathable membrane, ensuring that the battens and fixings are coincident with the underlying timber studs, head rails and sole plates.
- When selecting the type of fixing and fixing frequency for the battens, consideration must be given to the weight of the cladding to be fixed to them.
- Installation advice should be sought from the breathable membrane manufacturer, and the ventilated cladding system should be secured in accordance with its manufacturer's recommendations.
- *For external masonry cladding*, the outer leaf of masonry may be constructed in the conventional manner, using appropriate wall ties to hold the two wall leaves together.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)									
	U–values									
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30
Plaster skim	3	3	3	3	3	3	3	3	3	3
Plasterboard	15	15	15	15	15	15	15	15	15	15
Vapour control layer	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Timber stud cavity	80	90	90	100	105	110	115	115	120	120
Kingspan **Therma**wall® TW55 between timber studs	60	50	50	40	35	30	25	25	20	20
OSB sheathing	9	9	9	9	9	9	9	9	9	9
Kingspan **nilvent**®	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan **Therma**wall® TW55	60	60	50	50	40	40	30	25	25	20
Cavity	50	50	50	50	50	50	50	50	50	50
Brickwork	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5

Calculations assume 140 mm timber studs with a thermal conductivity of 0.12 W/m·K and 15% bridging factor.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Floors

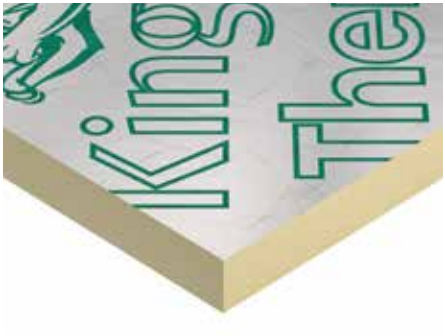
SOLID CONCRETE & SUSPENDED GROUND FLOORS

Kingspan **Therma**floor® TF70

Kingspan **Therma**floor® TF70 has a rigid thermoset polyisocyanurate (PIR) insulation core faced with a low emissivity composite foil on both sides.

Kingspan **Therma**floor® TF70 is suitable for use:

- insulating solid concrete floors; and
- insulating suspended ground floors.



Fibre-free Core

Product details:

- Thermal Conductivity – 0.022 W/m·K
- Compressive Strength – typically exceeds 140 kPa at 10% compression when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 2.4 m
- Thicknesses – 20 – 160 mm (speak to your local merchant or distributor for stocked sizes)
- BRE 2008 Green Guide Summary Rating – A+

Product benefits:

- Can reduce the cost of related items such as soil removal or relocation of service connections
- Easy to handle and install
- Ideal for new build and refurbishment
- Fibre–free core
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Visit **www.kingspaninsulation.co.uk** for further information

Installation Details – Insulation Below Floor Slab or Screed

Below Slab

- The site should be prepared and foundations, where appropriate, built to damp proof course (DPC) level.
- A thin sand blinding may be used to achieve a continuous level surface free from projections over rolled hardcore.

Below Screed

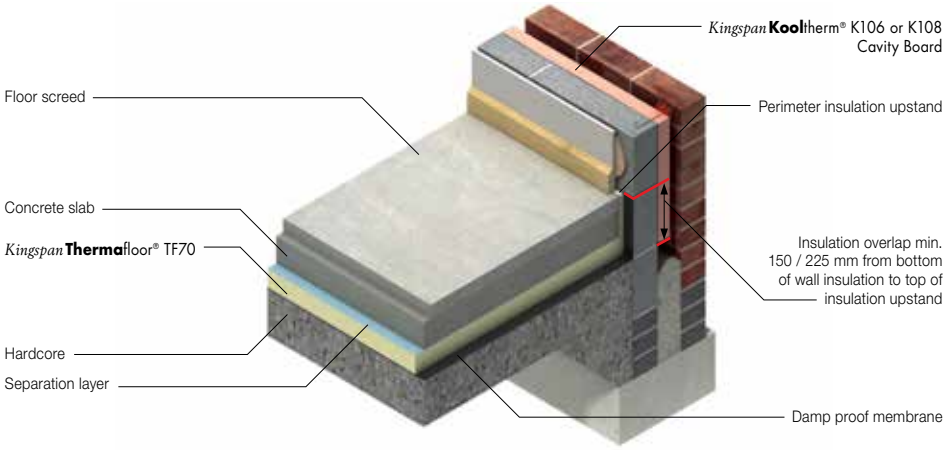
- Concrete slabs should be allowed to dry out fully prior to the installation of the insulation boards (average 1 day per mm of slab thickness).
- The surface of the slab should be smooth, flat and free from projections. Rough cast slabs should be levelled using a thin sand blinding to ensure boards are continuously supported.

All Floors

- The damp proof membrane (minimum 300 micron / 1200 gauge polythene) should be laid with joints well lapped and folded, to prevent the passage of ground water, over well compacted hardcore or the concrete floor slab, prior to laying the insulation boards.
- The membrane should be brought up the surrounding foundation walls until it is sufficiently above the height of the wall DPC so that it will connect with or form the DPC.
- The insulation boards should always be loose–laid break–bonded, with joints lightly butted.
- If two layers of insulation are required, they should be horizontally offset relative to each other so that, as far as possible, the board joints in the two adjacent layers do not coincide with each other.
- A strip of insulation board (minimum 20 mm thick) should be placed vertically around the perimeter of the floor in order to prevent cold bridging. The bottom of the strip of insulation board should be level with the top of the floor screed and the bottom should be level with the bottom of the horizontal floor insulation, and closely butted up to it.
- Insulation boards should be overlaid with a polythene sheet (not less than 125 micron / 500 gauge), to prevent the wet screed / concrete penetrating the joints between the boards, and to act as a vapour control layer. Ensure the polythene sheet has 150 mm overlaps, taped at the joints, and is turned up 100 mm at the walls.
- *For insulation below slab,* the subsequent installation of the concrete slab and screed or other flooring material is carried out in a manner similar to that for an un–insulated floor. The concrete slab and screed should be allowed to dry out prior to the installation of the floor finish.
- *For insulation below screed,* use sand and cement screed laid to a minimum thickness of 65 mm for domestic construction and 75 mm elsewhere.

Floors
SOLID CONCRETE & SUSPENDED GROUND FLOORS

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Screed	65	65	65	65	65	65	65
Concrete	150	150	150	150	150	150	150
Separation layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan **Therma**floor® TF70	80 + 80	135	115	90	80	70	55
Damp proof membrane	0.9	0.9	0.9	0.9	0.9	0.9	0.9

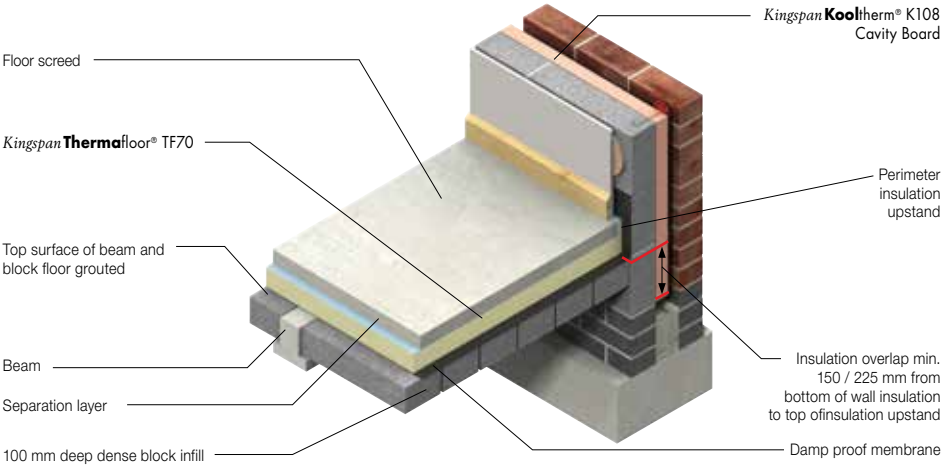
Calculations assume a P/A ratio of 0.5. The soil has been assumed to be sand or gravel.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Beam & Block Ground Floors Insulation Below Screed

- Beam and block floors should be level and grouted.
- The damp proof membrane (minimum 300 micron / 1200 gauge polythene) should be laid with joints well lapped and folded, to prevent the passage of ground water, over the concrete floor slab, prior to laying the insulation boards.
- The membrane should be brought up the surrounding foundation walls until it is sufficiently above the height of the wall DPC so that it will connect with or form the DPC.
- The insulation boards should always be loose–laid break–bonded, with joints lightly butted.
- If two layers of insulation are required, they should be horizontally offset relative to each other so that, as far as possible, the board joints in the two adjacent layers do not coincide with each other.
- A strip of insulation board (minimum 20 mm thick) should be placed vertically around the perimeter of the floor in order to prevent cold bridging. The bottom of the strip of insulation board should be level with the top of the floor screed and the bottom should be level with the bottom of the horizontal floor insulation, and closely butted up to it.
- Insulation boards should be overlaid with a polythene sheet (not less than 125 micron / 500 gauge), to prevent the wet screed penetrating the joints between the boards, and to act as a vapour control layer. Ensure the polythene sheet has 150 mm overlaps, taped at the joints, and is turned up 100 mm at the walls.
- Use sand and cement screed laid to a minimum thickness of 65 mm for domestic construction and 75 mm elsewhere.

Floors
SOLID CONCRETE & SUSPENDED GROUND FLOORS

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Screed	65	65	65	65	65	65	65
Separation layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan Thermafloor® TF70	85 + 80	135	115	90	80	70	60
Damp proof membrane	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Beam & block	100	100	100	100	100	100	100

Calculations assume a P/A ratio of 0.5. The soil has been assumed to be sand or gravel.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Suspended Timber Ground Floors (Insulation Between Joists)

Installation from Above the Floor Joists

- The installation of *Kingspan* **Therma**floor® TF70 in suspended floor constructions should be carried out before commencement of floor boarding.
- The insulation boards should be cut to fit snugly between the floor joists. Measure the distance between the joists prior to cutting the boards as spacings can vary.
- In order to ensure insulation boards are flush with the top surface of the joists, they should be supported on minimum 25 mm x 25 mm treated softwood timber battens, proprietary galvanised steel saddle clips, or galvanised nails partially driven into the side of the joists.
- Battens / nails should be placed at an appropriate height to suit the thickness of board being fitted, and nails should remain 40 mm proud of the joist.
- The insulation boards should then be fitted between the joists so that they are supported by the battens / saddle clips or nails.

Installation from Below the Floor Joists

- Floor boards should be fixed over joists prior to fitting *Kingspan* **Therma**floor® TF70 from below.
- The insulation boards should be cut to fit snugly between the floor joists. Measure the distance between the joists prior to cutting the boards as spacings can vary.
- Push the cut insulation boards between the joists so they are flush with the underside of the floor boards.
- Side–nail 25 mm x 25 mm timber battens to the joists or partially drive galvanised nails into the side of the joists in the appropriate position to hold the boards in place.

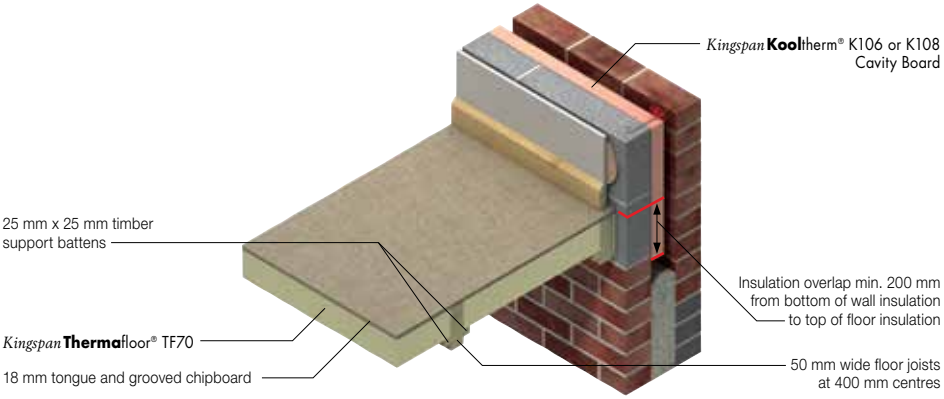
All methods of installation

- If two layers of insulation are required, they should be horizontally offset relative to each other so that, as far as possible, the board joints in the two adjacent layers do not coincide with each other.
- All board joints should be tightly butted.
- Ensure that insulation boards are fitted tightly between joists, and any gaps are filled with expanding urethane sealant.
- Any narrow gaps between a joist and perimeter wall should be insulated by specially cut pieces of board which in turn should be supported on blocks nailed to the underside of the joists. Gaps less than 25 mm wide should be filled with expanding urethane sealant.

Floors

SOLID CONCRETE & SUSPENDED GROUND FLOORS

Typical Construction & U-values



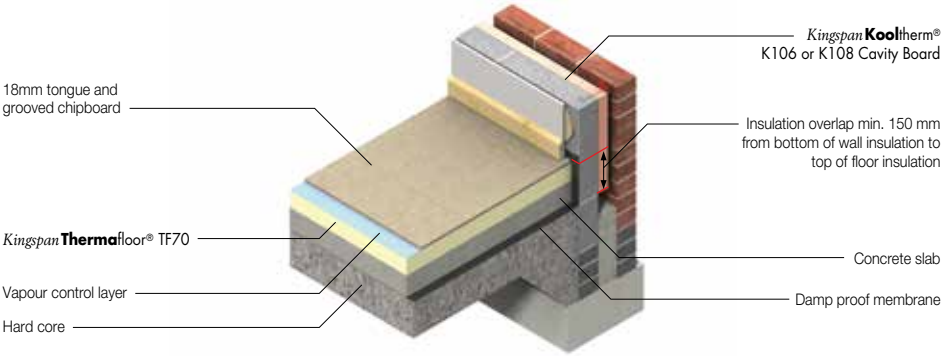
Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Tongue & groove chipboard	18	18	18	18	18	18	18
Vapour control layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan Thermafloor® TF70	110 + 110	90 + 90	145	105	95	75	60

Calculations assume a P/A ratio of 0.5. The insulation is laid between 50 mm wide floor joists at 400 mm centres. The soil has been assumed to be sand or gravel.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Floating Timber Ground Floor

- A thin layer of cement / sand mortar, a levelling screed, or a proprietary levelling compound can be used to achieve a level surface, and prevent the boards of *Kingspan* **Therma**floor® TF70 from slipping under the timber floor boards, if required. This should be allowed to set, harden and dry (approximately 1 day per mm) before proceeding further.
- If there is no damp proof membrane in the concrete floor, one (minimum 300 micron / 1200 gauge polythene) should be laid with joints well lapped and folded, to prevent the passage of ground water, over the concrete floor slab.
- The membrane should be brought up the surrounding foundation walls until it is sufficiently above the height of the wall DPC so that it will connect with or form the DPC.
- To comply with NHBC recommendations, preservative treated softwood timber battens should be positioned at doorways, access panels and to support partitions. The size of the battens selected should ensure that, when installed, the top surface of the insulation boards are flush with the top of the battens,
- The insulation boards should always be loose–laid break–bonded, with joints lightly butted.
- Insulation boards should be overlaid with a polythene sheet (not less than 250 micron / 1000 gauge), to act as a slip layer, and a vapour control layer. Ensure the polythene sheet has 150 mm overlaps, taped at the joints, and is turned up 100 mm at the walls.
- Timber floors should then be laid over the insulation and battens with staggered cross–joints in accordance with DD ENV 12872: 2000.
- An expansion gap of 2 mm per metre run of floor, or a minimum of 10 mm overall, whichever is greater, should be provided between the floor boards and the perimeter walls.
- Where there are long (over 5 metres), uninterrupted lengths of timber floor boards, proprietary intermediate expansion joints should be installed on the basis of a 2 mm gap per metre run.
- Before the timber floor boards are interlocked, apply a continuous bead of waterproof wood grade PVA adhesive to the top and bottom of the tongue and groove joints.
- Once timber floor boards have been laid, temporary wedges should be inserted between the walls and the floor, to maintain tight joints, until the adhesive has set.
- Once the wedges are removed, they are replaced with strips of cork or polyethylene foam to act as a compressible filler and to help prevent cold bridging. Skirtings may then be fixed.

Typical Construction & U-values



Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Tongue & groove chipboard	18	18	18	18	18	18	18
Vapour control layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan Thermafloor® TF70	80 + 80	130	115	90	75	65	55
Concrete slab	150	150	150	150	150	150	150
Damp proof membrane	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Calculations assume a P/A ratio of 0.5. The soil has been assumed to be sand or gravel.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Glossary

ACD Approved / Accredited Construction Details are a set of standardised construction details developed by regulators to deal with the issue of heat loss / gain and other issues.

Acoustic insulation is a product used to impede the transfer of sound, either via airborne or impact transfer. Typically internal constructions within buildings are required to utilise acoustic insulation products to aid in minimising the transfer of sound from one adjacent room into another. 'Approved Document E' and 'Part E – Robust Details' contain further information on common methods of controlling the transfer of sound in buildings.

Air tightness is the uncontrolled leakage of air from a building through cracks, unsealed penetrations or interfaces between different building elements.

Air infiltration is air passing into a building through cracks or gaps.

Ambient When referring to heat, temperature, etc. ambient describes the surrounding conditions. I.e. the ambient temperature is the average temperature surrounding a material.

Ballast A ballast layer is typically used in warm or inverted roofs down to weigh down the insulation or waterproofing system. Common items used to form ballast layers include concrete paving slabs, round washed pebbles or a green roof system (e.g. plants and growing medium such as soil). The weight of the ballast required is dependent on results from a wind uplift calculation.

BER Building Emission Rate details the energy performance of a building calculated following the NCM (National Calculation Methodology) e.g. SBEM. These measurements will be compared to the TER to define whether a building passes building regulations (Approved Documents L / Section 6).

BIM Building Information Modelling manages the information required for a construction project. This database is referred to as AIM (Asset Information Model). In accordance with the government's 'Construction Industry Strategy 2011', all new public constructions should use BIM from 2016.

Blowing agent A substance used during the manufacture of cellular foam insulation products. These agents are typically used to enhance the thermal performance of the finished product by filling the cells within the insulation with a low thermal conductivity gas. The **Kool**therm® and **Therma**™ ranges of insulation products Kingspan produce use blowing agents with zero Ozone Depletion Potential and low Global Warming Potential (GWP).

BPEO Best Practice Environmental Option includes initiatives such as Kingspan's Waste Collection Service.

BREEAM is an environmental assessment and rating system for buildings. It uses recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use.

Glossary

Breathability is a non–scientific term used when discussing moisture transport through a construction (see Ventilation).

Building Control Bodies are public and private organisations that assess and verify compliance with building regulations and standards.

Building envelope separates the internal and external environments, such as a roof or walls. In order to provide the adequate protection against heat leakage, the building envelope should have as few thermal bridges and unintended gaps a possible.

Built–up roof is a roof made up of layers of building elements, typically roofing felt and asphalt with waterproofing layer and gravel on top.

Butt joints are joints made from two materials placed end to end without overlapping. They are used in pipe insulation and when laying loose boards on a floor or roof.

Carrier membrane is a membrane typically used to provide a suitable substrate for laying another product, i.e. such as for a liquid applied waterproofing system to be applied onto. Refer to individual waterproofing manufacturers for specific recommendations on when such layers are required, and if they are what is used for them.

Cavity closers are insulated extrusions for closing wall cavities at openings such as window reveals and door reveals. Cavity closers reduce heat transfer, avoiding thermal bridging, condensation and mould growth. They can even be used to pre–form openings when window and door frames are fitted later. *Kingspan* **Kool**therm® Cavity Closer and *Kingspan* **Therma**bate® are examples.

CE label shows compliance with EN and CEN standards

Cellular insulation, such as polyurethane, polyisocyanurate and phenolic insulation, is made up of small individual cells.

Centres of rafter / joists are measured by taking the centre point of one joist / rafter to the centre point of the following adjacent joist / rafter. Timber joists and rafters are traditionally located at 400 mm, 450 mm or 600 mm centres, or in refurbishments sometimes their imperial approximate equivalents of 16, 18 and 24 inches.

Closed cell insulation has a more compact and denser structure than open cell insulation. As a result, it decreases the ingress of moisture and is more resistant to heat transmission. Insulation with a closed cell structure is also more resistant to flood damage. Because of its low water take–up, closed cell insulation panels recover from immersion in flood water more quickly than mineral fibre insulations for example.

Cold bridging is a type of thermal bridging that occurs when a structural element of a building lets heat flow through it because it has a lower thermal resistance than other components in the construction.

Compressive creep is the measure of how much a material changes under long–term load. Heavy duty insulation materials ideally have a low compressive creep so they have a suitable durability in heavy duty applications.

Compressive strength is a material's ability to maintain its structural integrity when compressed. Insulation products with a high compressive strength such as *Kingspan* **Styro**zone® are used for heavy duty floors and roofs.

Condensation is the conversion of a substance (typically water when referenced in the construction industry) from the vapour state to a liquid due to a change in temperature or pressure, e.g. such as warm moist air hitting a cold surface causing: a reduction in temperature of the air; and moisture vapour to condense out of the air.

The two main occurrences of condensation are:

- Surface Condensation which can lead to mould and staining through its formation on the visible surface of a material.
- Interstitial Condensation occurs between the layers of a construction. This type of condensation can both reduce the effectiveness of insulation components and reduce their lifespan.

Convection is the transfer of heat through movement of air.

Conduction is the transference of heat through a material, or from one material to another when they have direct contact.

CRA Condensation Risk Analysis is performed on the construction elements of a building, taking into account the order in which they appear, and the building's geographical location. Kingspan's Technical Service Department present CRA with U–value calculations.

DER Dwelling Emission Rate details the energy performance of a building calculated using SAP. These measurements will be compared to the TER to define whether a dwelling passes building regulations.

DFEE Dwelling Fabric Energy Efficiency. This is compared to the TFEE to comply with building regulations in England.

DPM Damp Proof Membrane is used with some insulation to prevent moisture building up on the insulation layer.

Emissivity is the 'shininess' of a material. A high emissivity will increase the amount of heat transfer through radiation. It is measured in watts per square metre (W/m^2) in relation to an ideal black surface as a ratio from 0 to 1. The closer to 0 the emissivity ratio, the lower the emission of heat as radiation. A foil facing on an insulation board allows a low emissivity to be taken when calculating the thermal resistance of an unventilated airspace, e.g. in a cavity wall construction.

Glossary

EPC Energy Performance Certificate is required upon completion of a dwelling in accordance with the English, Scottish and Welsh building standards. This necessitates energy calculations eg SAP or SBEM. They measure on a scale of A–G, the green to red scale covers the energy efficiency rating, while the blue to grey scale measures the environmental impact rating of the construction.

EPS Expanded Polystyrene is a light rigid foam insulation that has low thermal conductivity and high impact resistance.

EWI External Wall Insulation – insulation on the outside or cold side of a wall.

Facing is the surface element of an insulation board. Rigid and semi–rigid insulation boards often have a foil facing which lowers the emissivity of the insulation element.

Fibrous insulation is an insulation material made up of fibres rather than cells.

Fully bonded is typically used in reference to flat roofing, and refers to where a bond between two materials is considered to cover the whole surface. As a full bond covers a greater proportion of the roof area, these systems can generally provide greater restraint against wind uplift than partially bonded systems.

Geotextile membrane is a non–woven geo–synthetic membrane used in a variety of applications within the construction industry to act as separation and filtration membranes.

GWP Global Warming Potential is a relative measure of how much heat a greenhouse gas traps in the atmosphere, and in turn how much the product is estimated to contribute towards global warming. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide. A GWP is calculated over a specific time interval, commonly 20, 100 or 500 years.

Green Guide Rating The 2008 Green Guide Rating system uses data from Environmental Profiles to classify performance of construction materials in a number of areas to award a summary rating on a scale of E (worst) up to A+ (best).

H_{TB} or Transmission heat transfer Coefficient is associated with non–repeating thermal bridges. The H_{TB} is the overall sum of heat–loss / gain from each junction multiplied by that junction's length.

ISO International Standardisation Organisation is a certification body that proved assessments such as 9001–quality management, 14001–environmental management, 18001–Occupational Health and Safety (OHSAS), and 50001–energy management.

IWI Internal Wall Insulation – insulation on the inside or warm side of a wall.

Kappa value relates to the thermal mass of a construction. It is the measure of how much heat will be stored per metre squared of a building and represents 'k' in the unit of measure kJ/m^{2}K. 'k', or the heat capacity of a building, can be calculated using the following equation:

- k = 10 – 6 x Σ (dj rj cj)
- dj = thickness of layer (mm)
- rj = density of layer (kg/m^3)
- cj = specific heat capacity of layer (J/kg·K)

The calculation is over all layers in the element, starting at the inside surface and stopping at whichever of the following conditions is encountered first (which may mean part way through a layer):

- The total thickness of the layers exceeds 100mm
- The midpoint of the construction is reached
- An insulation layer is reached (defined as thermal conductivity ≤ 0.08 W/m·K)

Lambda value Sometimes called the 'k–value' or 'λ–value', measures the thermal conductivity of a material. k–value is shown in units of W/m·K where 'm' represents the thickness of the material in metres. Insulants have a low thermal conductivity meaning heat cannot pass through them easily. The k–value shows the general performance of a material with regards to thermal conductivity and does not relate to the material's thickness.

LCA Life Cycle Assessment is how the environmental impact of a building is assessed from raw materials to disposal or recycling.

Loose fill insulation For example cellulose or mineral insulations that are typically installed in the air cavities of buildings through a gap or drilled hole in the building element.

Moisture ingress is the act of water entering something. In construction terminology the term is typically used in reference to external moisture (i.e. ground moisture or precipitation) entering a construction.

MVHR Mechanical Ventilation with Heat Recovery: A system that ventilates a space by removing indoor air, recovering the heat from that indoor air, and using it to pre–heat fresh air from outside.

Open cell insulation has a structure that allows moisture and vapour to permeate through it.

OSB Oriented Strand Board, also known as OSB, Sterling board or Exterior board and is an engineered wood product formed by layering strands (flakes) of wood in specific orientations set within a resin to form a rigid board. The product is typically available in differing thickness from 6 – 25 mm, and comes in differing grades from 1–4. Grades 2–4 are most common, with grade 3 or 4 generally being used in structural applications. A common application for boards of this type is as a structural sheathing to timber frames where they enhance the bending and racking strength of the frame.

Glossary

P/A Ratio The perimeter / area ratio is worked out by dividing the exposed perimeter given by the floor area. This will calculate how much floor insulation is need. The exposed perimeter refers only to the walls that connect to an unheated space, so this will mainly be an outside space or areas such as a garage. The smaller the P/A figure the smaller the amount of insulation that is required, for example, a large area with a small exposed perimeter will have less heat loss and, therefore, will require less insulation.

Partial bonding is typically used in reference to flat roofing and relates to the method of bonding various components to the substrates beneath. When using a partial bond only a proportion of the two adjacent layers are bonded to one another, this can be to allow for a degree of differential movement, the release of gas during installation, or just due to discontinuity in the substrate, i.e. such as in the case of a profiled metal deck. When referring to built–up bituminous felt partially bonded systems are generally achieved by using a 3G perforated felt, which is loose laid above the substrate (i.e. deck or insulation) and the next layer of felt is then partially bonded to the substrate at the points of the perforations in the 3G layer.

Passivhaus or Passive House Standard. 'A Passivhaus is a building, for which thermal comfort can be achieved solely by post–heating or post–cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air.' The Passivhaus standard is a very high standard of energy efficiency by reducing levels of heat loss through high levels of insulation and preventing air loss, the building is heated passively through the sun, human occupants and household appliances with the remaining heat being supplied through heating or cooling of air in a mechanical ventilation system.

Phenolic Foam (PF) is an insulant such as *Kingspan* **Kool**therm® rigid phenolic boards. It has a high compressive strength and a closed cell structure. The thermal conductivity of phenolic foam is lower than that of rigid polyurethane or extruded polystyrene.

Plenum In ductwork, a plenum is a space above a ceiling that allows the collection of air in order to let it move between different spaces in the building.

PIR Polyisocyanurate foam is a rigid polymeric foam insulation.

Psi value or Ψ value is the measure of heat loss per kelvin shown in units of W/m·K where 'm' details the length of a junction in metres. It is used to estimate the potential for non–repeating thermal bridges.

PU is a family of rigid cellular thermoset polymeric foam with a close cell structure that forms both PIR and PUR based polymer foams. *Kingspan's* **Therma**™ range is made up of PU rigid urethane insulants.

PUR Polyurethane foam is a rigid polymeric foam insulation with a high thermal resistance and low thermal conductivity. It can be used on its own or to seal air gaps between existing insulation elements.

Radiation is also known as infrared radiation, this is the movement of heat through an open space which is not reliant on any contact between the heat source and the heated object.

Retrofit is the installation of insulation over pre–existing building elements or insulation.

RH Relative Humidity is a percentage that measures the relationship between the actual moisture content of the air and the saturated moisture content of the air.

R–value demonstrates thermal resistance of a material in relation to its thickness. It is measured in units of $m^2 \cdot K/W$ where 'm' represents the thickness of the material in metres which is divided by its value.

SAP Standard Assessment Procedure which measures the energy performance or efficiency of a domestic building. It covers the energy consumed in relation to the floor area, a fuel–cost–based efficiency rating, and CO_2 emissions. The procedure follows the structure of BREDEM (BRE Domestic Energy Model).

Sarking board are rigid boards, such as timber planks, plywood or OSB used above rafters in a pitched roof. The use of sarking boards is most common in Scotland, where traditionally sarking boards comprised softwood sawn planks fixed to the upper face of the rafters.

SBEM Simplified Building Energy Model assesses the energy efficiency of a non–domestic building. The software is used to measure the CO_2 emissions of non–domestic buildings and whether they comply with building regulations and standards.

SIPs Structural Insulated Panels are a combination of insulation and structural elements such as timber facings in one board. An example is the *Kingspan* **TEK**® Building System.

Soffit is the underside of an architectural component, for example an arch, beam, staircase or underneath car park decks. Insulations for this type of building element include *Kingspan* **Kool**therm® K110 Soffit Board and **Kool**therm® K110 PLUS Soffit Board.

Tanking membrane is a water proof membrane used to prevent moisture ingress further into a construction. Products of this type are often used in basement wall or floor constructions. A variety of materials ranging from membranes to liquid applied systems, with both bituminous, cementitous and synthetic plastic products all being available in the market place.

TER is the Target Emission which is based on a 'notional building', concurrent specification, which differs based on the country in which you are building (e.g. England, Wales or Scotland).

TFEE Target Fabric Energy Efficiency is an additional standard in England presented alongside the TER.

Thermal bridges are channels through which heat can be lost when a material has a higher thermal conductivity than adjacent building elements. They can also be referred to as Cold bridges or Heat bridges. The three main types of thermal bridges are:

- Repeating thermal bridges which develop in a regular pattern, for example where there are timber studs in walls. U–value calculations take account of the effect of repeating thermal bridges e.g. a 15% timber bridging fraction might be taken for studs in a timber framed wall.
- Non–repeating / linear thermal bridges occur in an irregular pattern at junctions between building elements e.g. around windows or between walls and floors.
- Point thermal bridges are used as adjustments to the U–value of a building element. They take account of thermal bridging at fixings, fasteners and beams.

Glossary

Thermal Conductivity is the measure of thermal conductivity used on materials in which heat transfer occurs through conduction, convection and radiation.

Thermal mass is how well an element absorbs, stores and releases heat per metre squared (See Kappa Value).

Thermal Resistivity As with thermal conductivity, this measures a material's ability to resist heat transfer through conduction, convection and radiation in relation to the material's thickness or surface emittance (see emissivity).

Thermoset is a type of insulation that sets permanently after cooling. If the insulation is reheated it will not change shape. Thermoset materials will not run, melt or drip when exposed to fire. Examples include *Kingspan's* **Kool**therm® and **Therma**™ ranges.

U–value is a sum of the thermal resistances of the layers that make up a building element i.e. walls, floors, roofs etc.). It includes adjustments for any fixings, air gaps etc. This value shows in units of $W/m^2 \cdot K$ the ability of an element to transmit heat from a warm space to a cold space in a building and vice versa.
The lower the U–value, the better insulated the building element is.

Ventilation is the process of 'changing' or replacing air in any space to remove excess moisture or other pollutants, such as carbon dioxide or ground gases such as radon and replaced with external air (See MVHR).

Water flow reduction layer is a membrane such as *Kingspan* **Aqua**zone® typically utilised within inverted roof constructions where it is laid above the thermal insulation to aid in minimising the cooling effect associated with rain water draining beneath thermal insulation. These products typically compose non–woven, spun–bonded polyolefin with micro–perforations which allow the escape of moisture vapour while preventing the majority of liquid water from peculating further down into the construction.

Wind uplift / Wind load calculation Wind can apply a positive or negative force onto objects depending on the construction detail, its orientation to the direction of wind, and the difference between internal and external air pressures. Wind load calculations are particularly important for systems restrained to the outside of a building, such as warm or inverted flat roofs and external wall insulation systems such as EWI render and rainscreen systems.

A wind load calculation considers a number of factors, such as the location and altitude of the building plot, local topography (i.e. geographical features, valleys, hillside etc.), adjacent structures which may shelter or funnel wind towards the building, also the construction type, its height from ground, and position on the construction in relation to the prevailing wind direction.

XPS Extruded Polystyrene has a high resistance to condensation damage and has a high thermal resistance. Kingspan Styrozone is a rigid extruded polystyrene.

Y–value is an approximation of a specific building's heat loss via its junctions. It is calculated by dividing the H_{TB} (overall thermal bridging coefficient) by the buildings's total exposed area (See H_{TB}).

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