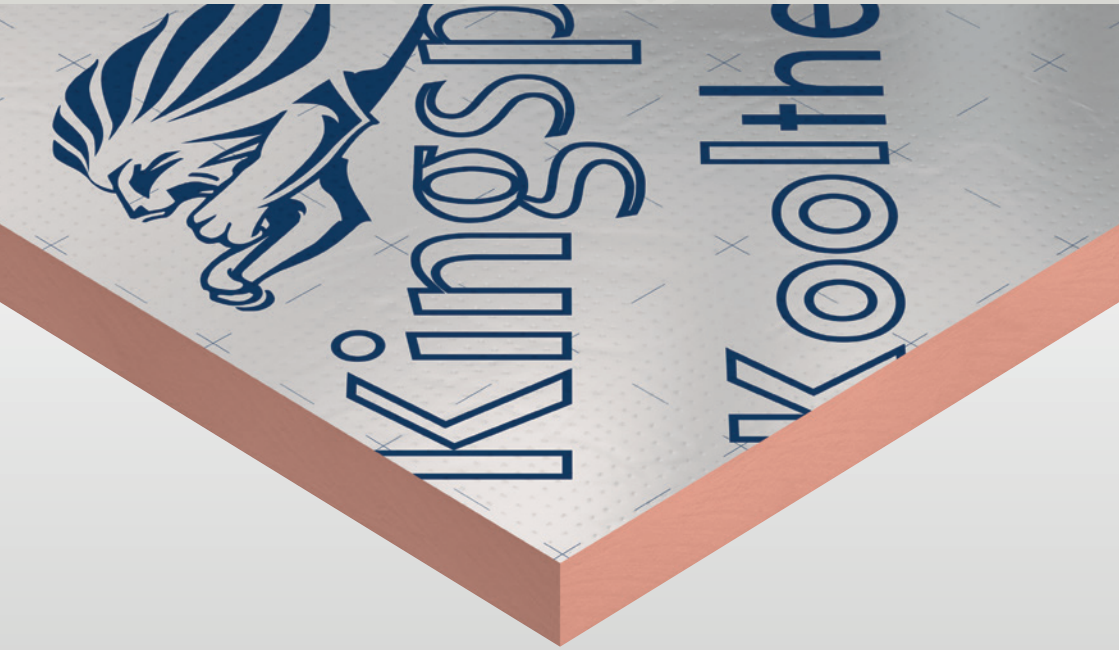
Insulation

Fourth Issue February 2020

Kooltherm®
Quick Guide



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.

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, Herefordshire and Selby, North Yorkshire manufacturing facilities are certified to BES 6001 (Framework Standard for the Responsible Sourcing of Construction Products) 'Excellent'. All **TEK**® and OPTIM-R® insulation product 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: 2015, ISO 14001: 2015, BS OHSAS 18001: 2007 and ISO 50001: 2011.

Insulation Product Benefits

Kingspan OPTIM-R™ Vacuum Insulation Panel (VIP) Products

- With a declared value thermal conductivity of 0.007 W/m·K, these products provide an insulating performance that is up to five times better than commonly used insulation materials.
- Provides high levels of thermal efficiency with minimal thickness.
- Over 90% (by weight) recyclable.

Kingspan **Kool**therm® and **Kool**therm® 100 Products

- With 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.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Kingspan **QuadCore**®

- With a thermal conductivity of 0.021 W/m·K this is amongst one of the more thermally efficient insulation products commonly used.
- Offering excellent thermal and fire performance, enhanced environmental credentials and backed by an extended warranty.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Kingspan **Therma**™ Products

- With a thermal conductivity of 0.022–0.028 W/m·K these are amongst the more thermally efficient insulation products commonly used.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Kingspan **GreenGuard**® Products

- Rigid extruded polystyrene insulation (XPS) has the necessary compressive strength to make it the product of choice for specialist applications such as heavy duty flooring, car park decks and inverted roofing.
- Manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

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.
- Each product achieves the required fire performance for its intended application.

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/m²·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

Scotland

The 2019 Editions of Technical Handbooks: Section 6 to the Building (Scotland) Regulations 2004 came into effect on October 1, 2019.

New Buildings

The main requirement of Technical Handbooks: Section 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 Section 6 gives 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.*

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 + A1: 2016 (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 + A1: 2016.

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.*

Breathable Sarking Membrane

BS 5250: 2011 + A1: 2016 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.

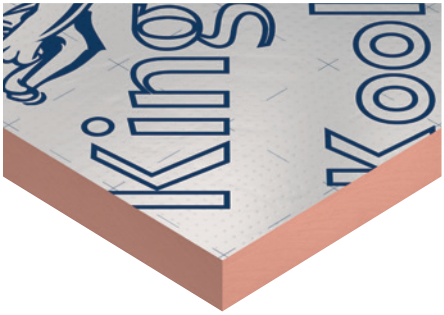
The next best solution is, therefore, insulation with no continuous surface for the breathable sarking membrane, and the breathable sarking membrane installed in vertical runs with laps sealed under counter–battens.

Kingspan **Kool**therm® K7 Pitched Roof Board

Kingspan **Kool**therm® K7 Pitched Roof Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Kool**therm® K7 Pitched Roof Board 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
  – 0.023 W/m·K (insulant thickness < 25 mm)
  – 0.021 W/m·K (insulant thickness 25 – 44 mm)
  – 0.020 W/m·K (insulated thickness ≥ 45 mm)
- Compressive Strength – typically exceeds 125 kPa, 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 – 150 mm (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Easy to handle and install
- Fibre–free core
- Ideal for new build and refurbishment
- 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

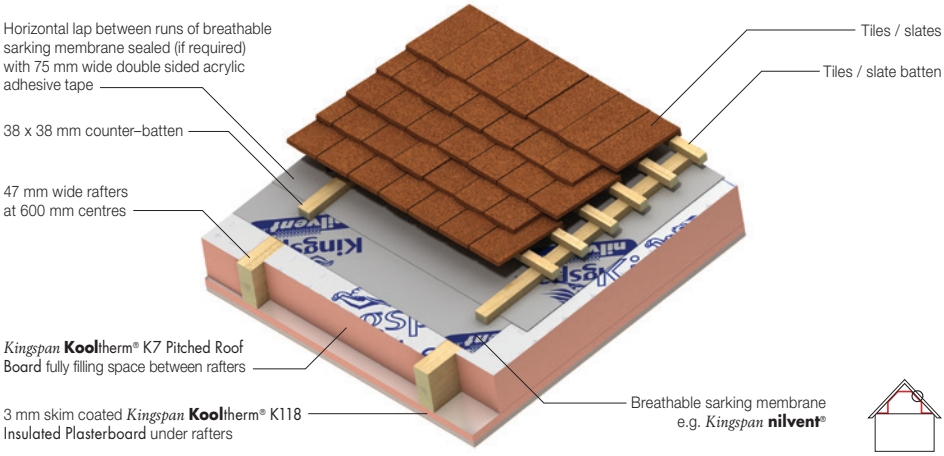
- Where the insulation between rafters fully fills the rafter depth, simply install the correct thickness of insulation, trimmed to suit rafter spacings, in such a manner that it is flush with the bottom and top of the rafters.
- If the between rafter insulation is to be fitted from the outside, install the insulation with the use of timber 'stop' battens.

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.

Pitched Roofs
VENTILATED & UNVENTILATED

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)						
Item	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	82.5	72.5	37.5	32.5	32.5	n/a
Kingspan **Kool**therm® K7 Pitched Roof Board between 150 mm timber rafters	150	150	150	150	120	90
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 rafters at 600 mm centres.
NB Speak to your local merchant or distributor for stocked board thicknesses.

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

Between Rafters

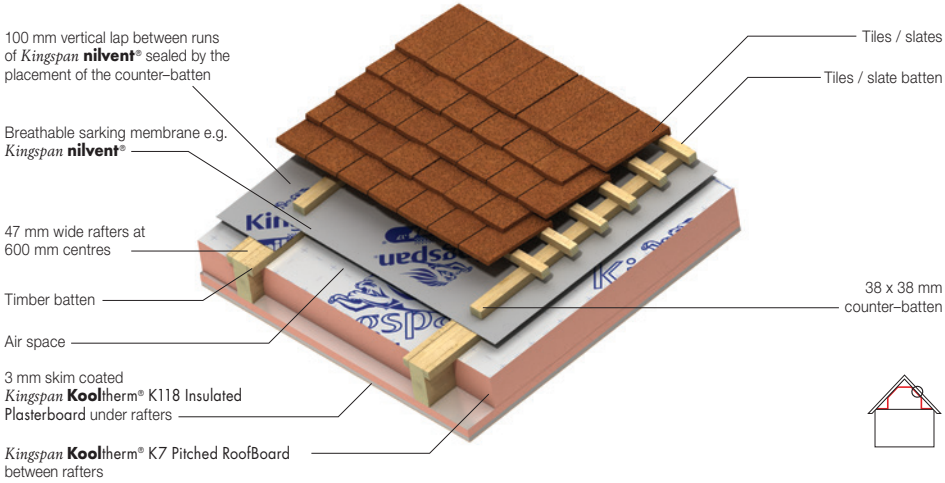
- *Kingspan* **Kool**therm® K7 Pitched Roof Board installed between rafters must be flush with the bottom of the rafters in order to prevent the risk of air movement between the board and the ceiling.
- Install the insulation, trimmed to suit rafter spacings, with the aid of treated softwood battens 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.

Pitched Roofs
VENTILATED & UNVENTILATED

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)						
Item	U–values					
	0.10	0.11	0.14	0.15	0.16	0.25
Plaster skim	3	3	3	3	3	3
Kingspan Kooltherm® K118 Insulated Plasterboard	82.5	72.5	42.5	32.5	32.5	n/a*
Kingspan Kooltherm® K7 Pitched Roof Board between timber rafters	130	130	130	130	120	90
Timber rafter cavity	20	20	20	20	20	60
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 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* **Kool**therm® K7 Pitched Roof Board 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.

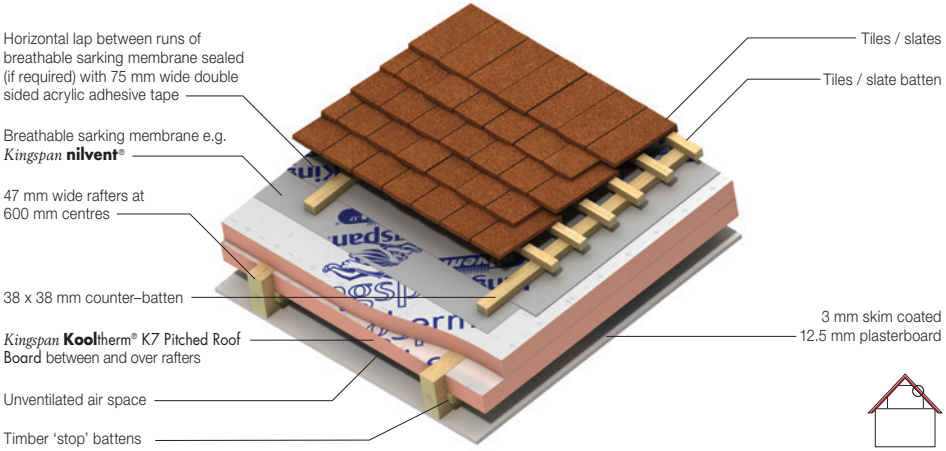
Over Rafters

- A preservative treated 'stop' rail should be secured to the rafters at the eaves.
- *Kingspan* **Kool**therm® K7 Pitched Roof Board 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, breathable membrane 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.

**NB If tiles are chosen instead of slates, this will require the use of counter battens and tiling battens over the breathable membrane to allow for water drainage and attachment of the tiles.*

Pitched Roofs
VENTILATED & UNVENTILATED

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
Timber cavity	0	0	30	40	40	60
Kingspan **Kool**therm® K7 Pitched Roof Board between timber rafters	100	100	70	60	60	40
Kingspan **Kool**therm® K7 Pitched Roof Board fixed above rafters	120	100	70	70	60	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* **Kool**therm® K7 Pitched Roof Board 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.

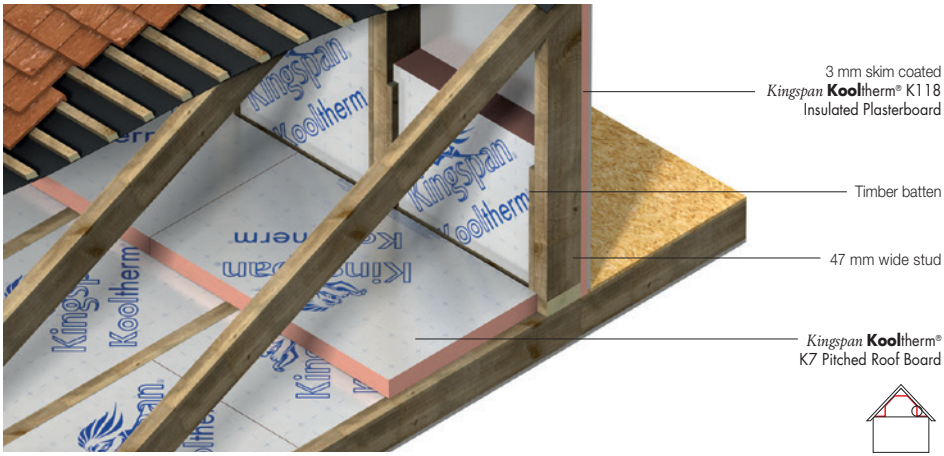
Inside Dwarf Wall Studs Insulation

- Please see fixing details on page 42.

Pitched Roofs

VENTILATED & UNVENTILATED

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
Plaster skim	3	3	3	3	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	62.5	52.5	52.5	42.5	32.5	32.5	32.5	32.5	n/a*	32.5
Kingspan **Kool**therm® K7 Pitched Roof Board between timber studs	100	100	100	100	100	90	70	70	100	50
Ventilated loft void	500	500	500	500	500	500	500	500	500	500
Sarking felt	2	2	2	2	2	2	2	2	2	2
Tiles / slates on battens	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
Plaster skim	3	3	3	3	3	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	62.5	52.5	42.5	37.5	37.5	32.5	32.5	32.5	n/a*	n/a*
Kingspan **Kool**therm® K7 Pitched Roof Board between timber studs	90	100	100	100	75	80	60	60	90	80
Unventilated loft void	500	500	500	500	500	500	500	500	500	500
Kingspan **nilvent**®	2	2	2	2	2	2	2	2	2	2
Tiles / slates on battens	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

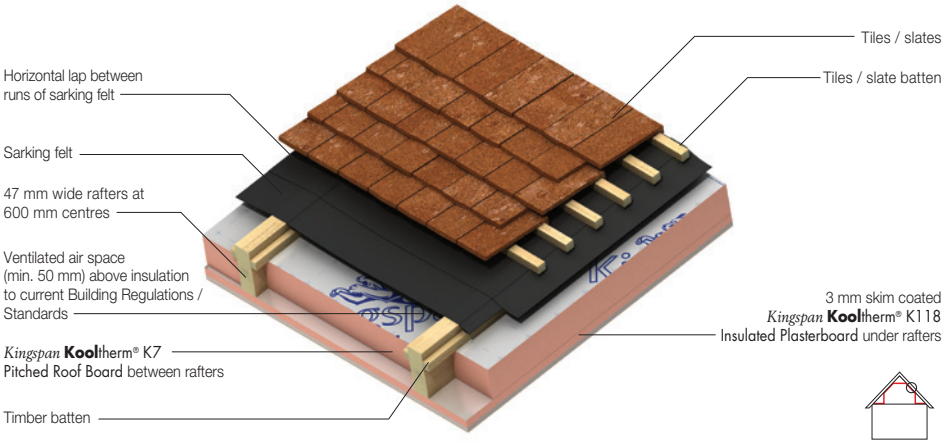
- *Kingspan* **Kool**therm® K7 Pitched Roof Board installed between rafters must be flush with the bottom of the rafters in order to prevent the risk of air movement between the board and the ceiling.
- Install the insulation, trimmed to suit rafter spacings, with the aid of treated softwood battens 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.

Pitched Roofs
VENTILATED & UNVENTILATED

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)						
Item	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	82.5	72.5	32.5	32.5	32.5	32.5
Kingspan **Kool**therm® K7 Pitched Roof Board between timber rafters	150	150	150	140	130	70
Ventilated rafter cavity	50	50	50	50	50	50
Sarking felt	2	2	2	2	2	2
Tiles / slates on battens	30	30	30	30	30	30

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

Masonry Walls

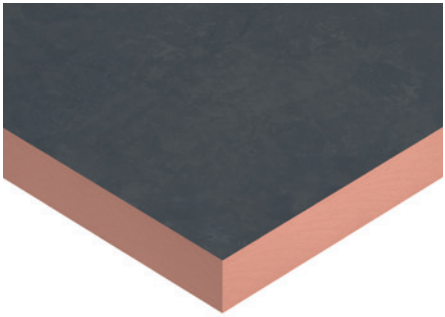
FULL FILL CAVITY WALL INSULATION

Kingspan **Kool**therm® K106 Cavity Board

Kingspan **Kool**therm® K106 Cavity Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on one side with a low emissivity composite foil, and faced on the other side with a water–tight, vapour–open polypropylene fleece.

Kingspan **Kool**therm® K106 Cavity Board is suitable for use:

- as cavity insulation with a residual 10 mm cavity; and
- with insulated plasterboard on the inner leaf.



Fibre-free Core

Product details

- Thermal Conductivity – 0.018 W/m·K
- Compressive Strength – typically exceeds 100 kPa, 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 – 80 – 115 mm (speak to your local merchant or distributor for stocked sizes). Please contact sales@kingspaninsulation.co.uk for lead times as these may vary dependent on current stock profile.

Product benefits

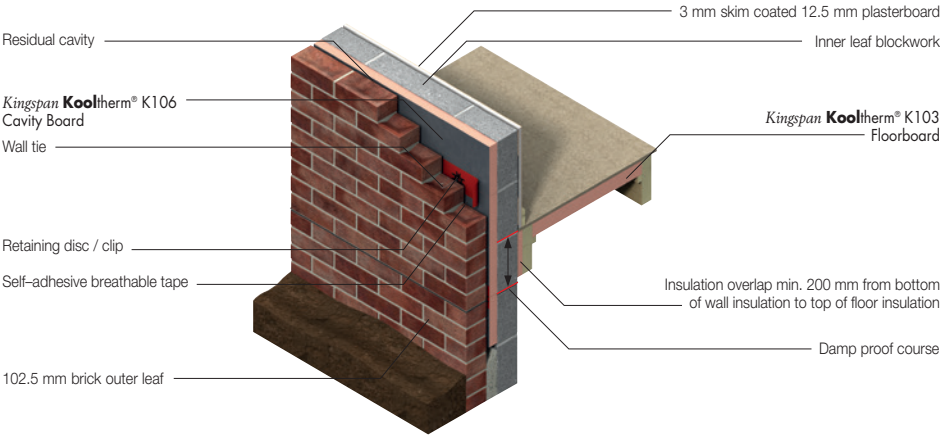
- Resists moisture penetration by allowing a clear cavity to be maintained
- Easy to handle and install
- Boards are designed to fit easily with standard brick and block dimensions
- Board sizes allow the insertion of wall ties at appropriate spacing
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details

Cavity Insulation

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- *Kingspan* **Kool**therm® K106 Cavity Board 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 of a thickness no greater than 10 mm.
- For a solid concrete ground floor 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 two block courses).
- The next course of wall ties is positioned no greater than 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 + A1: 2016, BS EN 1996-1-1: 2005, BS EN 1996-2: 2006, BS EN 1996-3: 2006, PD 6697: 2010 and / or to ensure adequate retention of boards or cut pieces.
- Wraptite, a self–adhesive breathable tape, no less than 100 mm wide, should be applied to all horizontal and vertical joints, board edges and abutting junction interfaces e.g. *Kingspan* **Kool**therm® Cavity Closer. The seal must be maintained at protrusion locations e.g. wall ties.
- To ensure successful adhesion, all surfaces to receive tape should be made clean and dry prior to application. A gentle pressure may also be exerted during application.
- 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 200 mm beyond the height of the top storey ceiling and a cavity tray installed above the insulation.
- After raising each section of inner leaf, before installation of the insulation board, excess mortar should be removed and mortar droppings cleaned from exposed edges of the installed installation boards.
- To protect board edges and to maintain a clear cavity, it is recommended that a draw cavity timber e.g. a piece of plywood or OSB of a thickness no greater than 10 mm, is used.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)				
Item	U–values			
	0.15	0.16	0.17	0.18
Plaster skim	3	3	3	3
Plasterboard	12.5	12.5	12.5	12.5
Plaster dabs cavity	15	15	15	15
Blockwork	100	100	100	100
Kingspan Kooltherm® K106 Cavity Board	105	100	90	85
Cavity	10	10	10	10
Brickwork	102.5	102.5	102.5	102.5

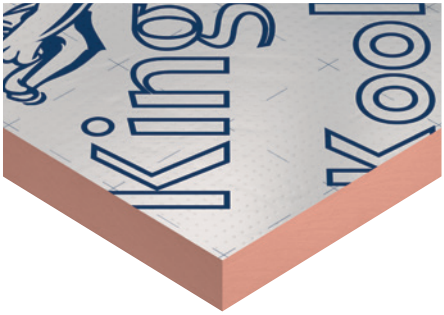
Calculations assume inner leaf blockwork of medium density (0.51 W/m·K).
NB Speak to your local merchant or distributor for stocked board thicknesses. Please contact sales@kingspaninsulation.co.uk for lead times as these may vary dependent on current stock profile.

Kingspan **Kool**therm® K108 Cavity Board

Kingspan **Kool**therm® K108 Cavity Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Kool**therm® K108 Cavity Board is suitable for use:

- as partial fill insulation in cavity walls; and
- with insulated plasterboard on the inner leaf.



Fibre-free Core

Product details

- Thermal Conductivity – 0.018 W/m·K
- Compressive Strength – typically exceeds 100 kPa, 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 – 20 – 150 mm (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Resists moisture 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

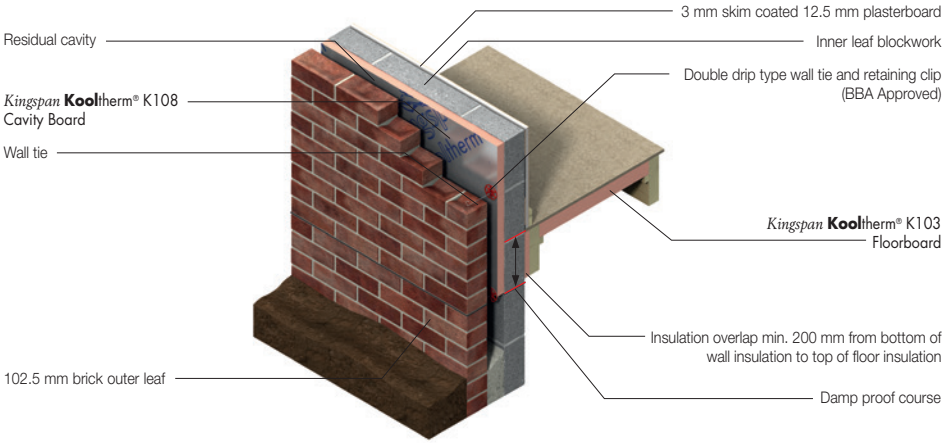
Installation Details – Cavity Insulation

Cavity Insulation

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- *Kingspan* **Kool**therm® K108 Cavity Board 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 + A1: 2016, BS EN 1996-1-1: 2005, BS EN 1996-2: 2006, BS EN 1996-3: 2006, 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 WALL 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	0.55
Plaster skim	3	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	12.5
Plaster dabs cavity	15	15	15	15	15	15	15	15	15	15	15
Blockwork	100	100	100	100	100	100	100	100	100	100	100
Kingspan **Kool**therm® K108 Cavity Board	100	90	85	75	60	60	50	45	40	35	20
Cavity	50	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	102.5

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

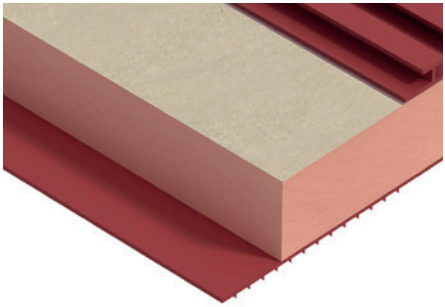
Masonry Walls

CAVITY CLOSER INSULATED EXTRUSIONS FOR CLOSING MASONRY WALL CAVITIES AT OPENINGS FOR USE IN ENGLAND AND WALES ONLY

Kingspan **Kool**therm® Cavity Closer & **Kool**therm® Cavity Closer PLUS

Kingspan **Kool**therm® Cavity Closer & *Kingspan* **Kool**therm® Cavity Closer PLUS are suitable for use with:

- PVC window and door frames in England and Wales only.



Fibre-free Core

Product details

- Meets minimum BBA R–value requirements for use as a cavity closer
- Section Length – 2.4 m
- Widths Available – 50 – 150 mm (sections can be joined to suit cavity widths up to 300 mm)

Product benefits

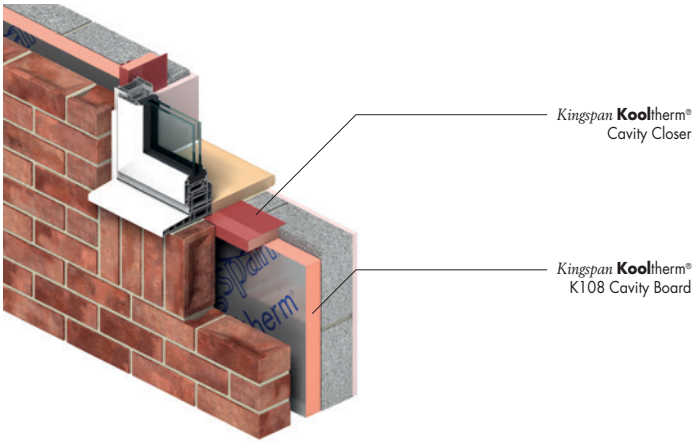
- Simplified construction – avoids the need for cut bricks, blocks or special reveal blocks
- Reduces thermal bridging, condensation risk and mould growth
- Improves weather resistance by forming an integral DPC
- Can be fitted with PVC door / window frames as a combined unit
- Easy to handle and install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

Masonry Walls

CAVITY CLOSER INSULATED EXTRUSIONS FOR CLOSING WALL CAVITIES AT OPENINGS

Installation Details

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- Construct the opening as normal.
- Cut out and clear away masonry / mortar that closes / protrudes into the cavity and insert lengths of *Kingspan* **Kool**therm® Cavity Closer.
- The fixing flange should always overlap the inner leaf masonry by 15 mm (min.), be tight to the masonry and securely fixed with a suitable masonry fixing through the holes provided in the fixing flange.
- *Kingspan* **Kool**therm® Cavity Closer should fit tightly into the cavity opening and no gaps should be left between the closer and either wall leaf.
- An appropriate lintel and damp proof course is incorporated at the head.
- Where an insulated lintel is used a head closer section will not be required and the jamb sections of the closer will butt up against the lintel. If required, a *Kingspan* **Kool**therm® Cavity Closer section can be used at the head where a separate lintel is used for each leaf.

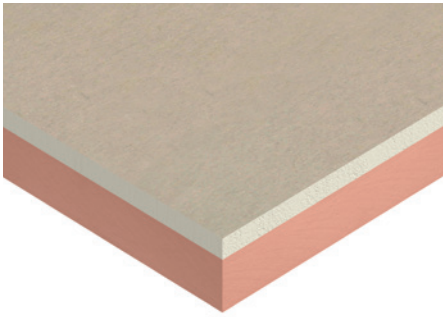


Kingspan **Kool**therm® K118 Insulated Plasterboard

Kingspan **Kool**therm® K118 Insulated Plasterboard has a premium performance fibre–free rigid thermoset phenolic insulation core with 12.5 mm plasterboard bonded to its front surface and a low emissivity composite foil facing on its reverse surface.

Kingspan **Kool**therm® K118 Insulated Plasterboard is suitable for use:

- in mechanically fixed applications;
- in adhesively bonded applications; and
- for new build, retrofit and refurbishment.



Fibre-free Core

Product details

- Thermal Conductivity – 0.018 W/m·K
- Compressive Strength – typically exceeds 100 kPa, 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 – 80 mm* (speak to your local merchant or distributor for stocked sizes)

**Thicknesses excludes 12.5 mm plasterboard component.*

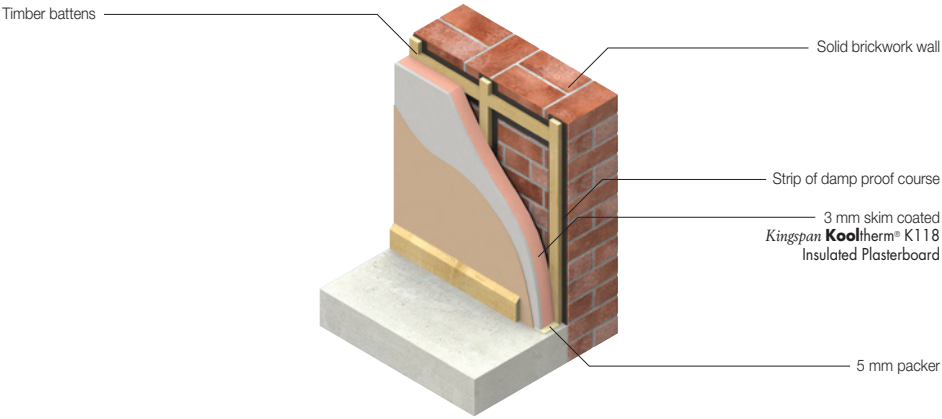
Product benefits

- Achieves European Classification (Euroclass) B-s1,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).
- Insulation, dry–lining and vapour control in one board
- Allows quick response heating
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details – Mechanically Fixing to Timber Framing Studs / Battens

- This method may be used on timber frame constructions or on dry, stable constructions capable of supporting battens and associated fixings. Timber battens can be packed out using proprietary shims to correct alignment and provide a space to accommodate services.
- Guidelines should be marked out at maximum 600 mm centres to indicate the positioning of the vertical battens.
- Vertical timber framing studs / battens should be set at maximum 600 mm horizontal centres, around the perimeter of the walls, at floor and ceiling, and around any openings and services which penetrate the system.
- If fixing to battens, they should be mechanically fixed to the wall, and comprise 25 x 47 mm (min.) treated softwood, backed with a strip of damp proof course (DPC).
- Each sheet of *Kingspan* **Kool**therm® K118 Insulated Plasterboard should lap timber framing studs / battens / noggins by 19 mm (min.) at sheet joints.
- Battens should be fixed approximately 75 mm from the ends of each timber batten and positioned at a maximum 600 mm apart.
- Where joints between sheets of insulated plasterboard are unsupported by the timber framing studs / battens, timber noggins should be installed.
- Each sheet of insulated plasterboard should be lightly butted, with fixings located no less than 10 mm from the bound edges of the sheet.
- *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be cut approximately 5 mm short of the floor to ceiling height.
- Sheets of *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be located centrally over the timber studs / battens and fixed using either drywall screws at 300 mm centres (or 200 mm at external corners), or large headed galvanised clout nails at 150 mm centres. Each sheet of insulated plasterboard should be lightly butted.
- When installing sheets onto timber, fixings should be long enough to allow minimum 25 mm penetration of the timber frame or minimum 22.5 mm penetration of the timber battens. Fixings should not penetrate through the battens.
- 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 and the 5 mm clearance gap at the base of the wall should be sealed with a flexible sealant or equivalent.

Typical Construction & U-values



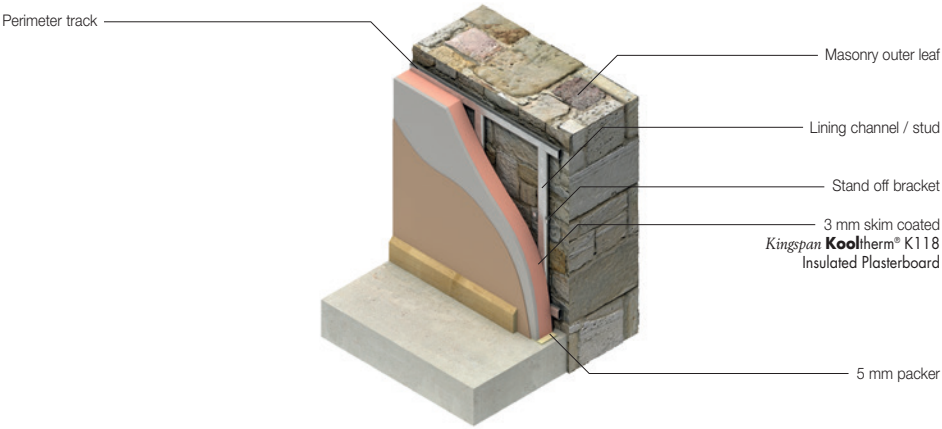
Thickness (mm) of material to achieve U–values (W/m²·K)					
Item	U–values				
	0.22	0.25	0.26	0.28	0.30
Plaster skim	3	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	82.5	72.5	67.5	62.5	57.5
Timber batten cavity	25	25	25	25	25
Brickwork	215	215	215	215	215

Calculations assume timber battens at 600 mm centres and carbon steel fasteners of cross sectional area 4 mm² at a density of 16.7 per m².
NB Speak to your local merchant or distributor for stocked board thicknesses.

Installation Details – Mechanically Fixing to Metal Wall Liner Systems

- This method may be used on any dry, stable constructions capable of supporting the stand–off brackets, tracks and associated fixings. It can be used to correct substantial substrate irregularities, or where a larger cavity is required to accommodate services.
- Because metal framing systems are proprietary, sitework guidance should be sought from the framing system manufacturer.
- However, in the absence of any other guidance, the instructions laid out below may be followed.
- The maximum undulation on the wall or service protrusion should be measured to determine the required cavity depth.
- Guidelines should be marked out on the floor and ceiling to indicate where the metal tracks will be positioned.
- The metal tracks should be fixed to the floor, ceiling and perimeters at a maximum of 600 mm centres using appropriate fixings for the proprietary system.
- Vertical guidelines should be marked out on the wall at a maximum 600 mm centres to indicate the position of the lining channels. Horizontal marks should also be made at 800 – 900 mm vertical centres (see manufacturers details for specific dimensions) to indicate the fixing points for the individual stand–off brackets. Brackets should be fixed using appropriate fixings.
- The lining channels should be fitted and fixed into the metal tracks at ceiling and floor level at a maximum of 600 mm centres, in line with the stand–off bracket positions, using appropriate fixings for the proprietary system, extending if required.
- Bracket legs on the stand–off brackets should be bent forward. Screws should then be inserted through holes in the brackets and fixed to the lining channels using appropriate fixings, such as 13 mm wafer headed drywall screws or jack point screws. Bracket legs can then be bent back to sit clear of the channel face.
- At internal angles or corner, a lining channel or track should be positioned tight into the corner to provide support for the lining.
- Fixing straps or fixing T's should be used to secure unsupported board joints. Metal channels or tracks should also be positioned around the perimeter of openings to support the board.
- *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be cut approximately 5 mm short of the floor to ceiling height.
- *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be located centrally over the metal lining channels and fixed using self–tapping drywall screws at 300 mm centres (or 200 mm at external corners). Each sheet of insulated plasterboard should be lightly butted.
- Fixings should be located no less than 10 mm from bound edges of the sheet, and be long enough to allow minimum 10 mm penetration of the metal.
- Fixings should be driven straight, with the heads embedded just below the surface of the plasterboard.
- Care should be taken not to overdrive screws.
- The perimeter of the *Kingspan* **Kool**therm® K118 Insulated Plasterboard and the 5 mm clearance gap at the base of the wall should be sealed with a flexible sealant or equivalent.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)				
Item	U–values			
	0.25	0.26	0.28	0.30
Plaster skim	3	3	3	3
Kingspan **Kool**therm® K118 Insulated Plasterboard	77.5	72.5	67.5	62.5
Metal frame cavity	25	25	25	25
Sandstone	450	450	450	450

Calculations assume metal studding / channels at 600 mm centres and carbon steel fasteners of cross sectional area 4 mm² at a density of 16.7 per m². NB Speak to your local merchant or distributor for stocked board thicknesses.

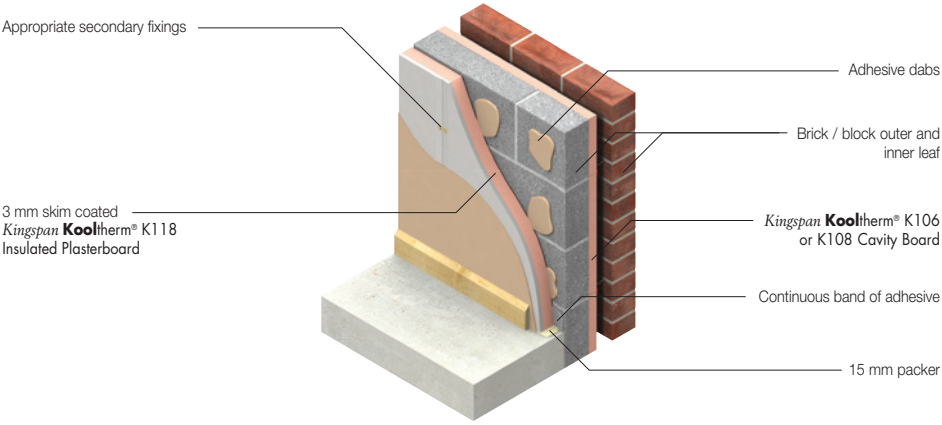
Installation Details – Drywall Adhesive Dab Bonding

- This method is suitable for use on brick, block or concrete cavity or rendered solid walls, which are dry, stable and free from moisture penetration.
- This method is not suitable for use directly on non–rendered solid masonry walls where there is a risk of moisture penetration, or on timber or steel frame construction.
- The cavity formed by the dabs can be used to incorporate services less than 25 mm in depth. Alternatively, minimum chasing of the background will be required.
- Minor irregularities of the substrate can be corrected within the dab depth. Typically, gypsum based adhesive should be applied in dabs of 10 – 25 mm thickness, therefore the existing substrate should not exceed a 15 mm tolerance from the high spot of the background to either end of the wall.
- A bonding agent may be required on the substrate to reduce suction or improve mechanical key. This should be applied in continuous bands to correspond with the drywall adhesive dab or band locations.
- After establishing the high point, guidelines should be marked out on the floor and ceiling at 1,200 mm horizontal centres to indicate where the edges of the *Kingspan* **Kool**therm® K118 Insulated Plasterboard should finish.
- Please refer to the full product literature for details of suitable adhesives.
- The drywall adhesive should be appropriate for use on the intended masonry substrate. Advice should be sought from the plaster / drywall adhesive manufacturer for its recommended system.
- *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be cut approximately 15 mm short of the floor to ceiling height.
- Some adhesives will require an additional bonding agent – please refer to the full product literature for further details.
- A continuous band of drywall adhesive is applied around the perimeter of each wall and around any openings or services, in order to support the insulation board, provide an air–tight seal and act as a fire stop.
- The adhesive adjacent to the board joints should be applied approximately 25 mm in from the edge of the boards to avoid bridging the joint.
- Adhesive dabs are generally applied to the background in three vertical rows, but a minimum of 20 % of the insulated plasterboard area should be covered with adhesive. Each drywall adhesive dab should be 50 to 75 mm wide and approximately 250 mm long, positioned vertically at approximately 300 mm centres and horizontally at 600 mm centres.
- Sheets of *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be positioned with the bottom edge resting on packing strips.
- The boards should be lifted tight to the ceiling using a foot–lifter and supported by the packing strips until the adhesive sets. If the wall height exceeds 2,400 mm, start from the bottom of the wall, working upwards, to allow boards to be held on the lower level of the wall and prevent any boards from sliding down.
- The boards should then be tapped back to align with the predetermined guidelines on the floor and ceiling. The use of a spirit level is recommended to provide a vertical plumb finish.
- The adhesive should set in approximately 1.5 – 3.5 hours. During this time, appropriate secondary fixings must be used in addition to the drywall adhesive. These must be located no less than 15 mm from the edges of the sheet. For guidance on the specification and number of secondary fixings, please refer to the full product literature.

Visit www.kingspaninsulation.co.uk for further information

- It is recommended that appropriate secondary fixings are positioned in the tapered edge of the sheets so that they are covered when the board is finished (e.g. joints taped and 3 mm skim coating).
- Fixings should be long enough to allow minimum 25 mm penetration into the fair faced masonry.
- Fixings should be driven straight, with the heads embedded just below the surface of the plasterboard.
- Care should be taken not to overdrive screws.
- Each sheet of insulated plasterboard should be lightly butted.
- The perimeter of the *Kingspan* **Kool**therm® K118 Insulated Plasterboard and the 15 mm clearance gap at the base of the wall should be sealed with a combination of flexible polyurethane foam and flexible sealant or equivalent.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)										
Item	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	52.5	47.5	42.5	32.5	82.5	77.5	67.5	62.5	57.5	52.5
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 **Kool**therm® K108 Cavity Board	50	50	50	50	n/a	n/a	n/a	n/a	n/a	n/a
Cavity	50	50	50	50	100	100	100	100	100	100
Brickwork	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5

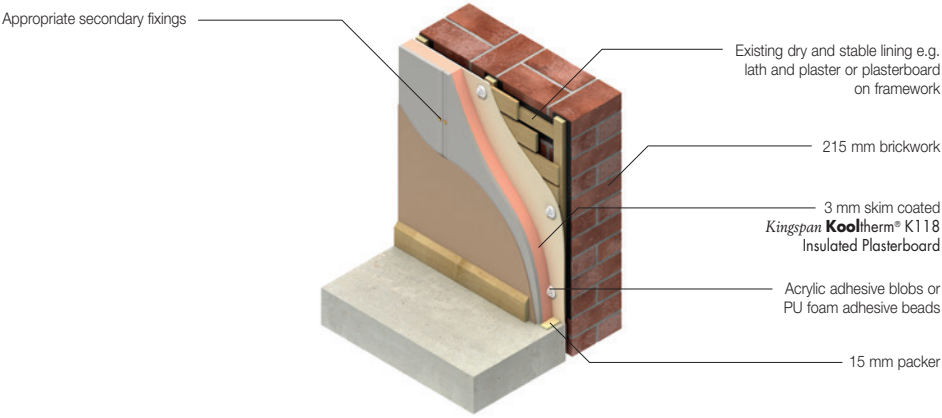
Calculations assume carbon steel fasteners of cross sectional area 4 mm² at a density of 16.7 per m² and an inner leaf blockwork of medium density (0.51 W/m·K).
NB Speak to your local merchant or distributor for stocked board thicknesses.

Visit www.kingspaninsulation.co.uk for further information

Installation Details – Acrylic Sealant / PU Foam Adhesive Bonding

- This method is suitable for use on flat brick, block or concrete cavity or rendered solid walls, which are dry, stable and free from moisture penetration.
- This method is also suitable for use on linings such as lath and plaster, plaster or plasterboard, providing the existing structure is dry, stable and free from moisture penetration.
- This method is not suitable for use directly on non–rendered solid masonry walls where there is a risk of moisture penetration.
- In order to provide sufficient space for services, the background will need to be chased out, unless the services exist within the wall or are contained within the lining framework cavity. Existing services should be assessed to determine any alterations that may need to be made, for example relocating sockets and switches.
- After establishing the highest point on the substrate, guidelines should be marked out on the floor and ceiling. The existing substrate should be within a 5 mm tolerance when measured with a 2,000 mm straight edge.
- Guidelines should be marked out on the walls at 1,200 mm horizontal centres to indicate where the edges of *Kingspan* **Kool**therm® K118 Insulated Plasterboard should finish.
- *Kingspan* **Kool**therm® K118 Insulated Plasterboard should be cut approximately 15 mm short of the floor to ceiling height.
- Please refer to the full product literature for details of suitable adhesives.
- Acrylic sealant adhesive should be gun–applied to the wall or back of the board in blobs at 300 mm centres, horizontally and vertically.
- PU foam adhesive should be gun–applied to the wall or back of the board in continuous beads 20 – 25 mm wide. A minimum of 3 vertical beads should be applied per board (unless otherwise stated by the PU foam adhesive manufacturer). A continuous bead of PU foam adhesive should also be applied horizontally at the top and the bottom of the board.
- The adhesive adjacent to the board joints should be applied approximately 25 mm in from the edge of the boards to avoid bridging the joint.
- The boards should be lifted tight to the ceiling using a foot–lifter and supported by the packing strips until the adhesive sets. If the wall height exceeds 2,400 mm, start from the bottom of the wall, working upwards, to allow boards to be held on the lower level of the wall and prevent any boards from sliding down.
- The boards should then be tapped back to align with the predetermined guidelines on the floor and ceiling. The use of a spirit level is recommended to provide a vertical plumb finish.
- Once the adhesive has set, appropriate secondary fixings should be used in addition to the adhesive. For guidance on the specification and number of secondary fixings, please refer to the full product literature.
- Secondary fixings should be applied 15 mm in from the edge of the sheet, after the adhesive has set.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)										
Item	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	122.5	112.5	107.5	102.5	87.5	82.5	77.5	72.5	67.5	62.5
Acrylic sealant / PU foam adhesive	3	3	3	3	3	3	3	3	3	3
Lath and plaster	13	13	13	13	13	13	13	13	13	13
Timber batten cavity	25	25	25	25	25	25	25	25	25	25
Brickwork	215	215	215	215	215	215	215	215	215	215

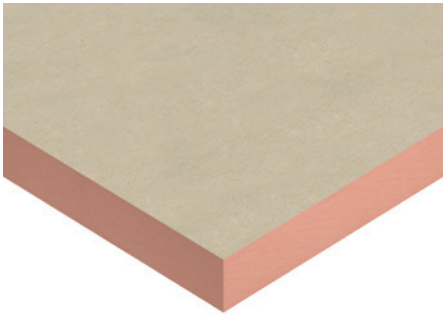
Calculations assume timber battens at 600 mm centres and carbon steel fasteners of cross sectional area 4 mm² at a density of 16.7 per m².
NB Speak to your local merchant or distributor for stocked board thicknesses.

Kingspan **Kool**therm® K5 External Wall Board

Kingspan **Kool**therm® K5 External Wall Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a glass tissue based facing.

Kingspan **Kool**therm® K5 External Wall Board is suitable for use:

- behind traditional and lightweight polymer modified renders; and
- for new build and refurbishment.



Fibre-free Core

Product details

- Thermal Conductivity
  – 0.023 W/m·K (insulant thickness 15 – 24 mm)
  – 0.021 W/m·K (insulant thickness 25 – 44 mm)
  – 0.020 W/m·K (insulant thickness ≥ 45 mm)
- Compressive Strength – typically exceeds 120 kPa, when tested to BS EN 826: 2013 (Thermal insulating products for building applications. Determination of compression behaviour)
- Board Size – 1.2 x 0.6 m
- Thicknesses – 20 – 120 mm (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Achieves European Classification (Euroclass) C-s1,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).
- Unaffected by air infiltration
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP

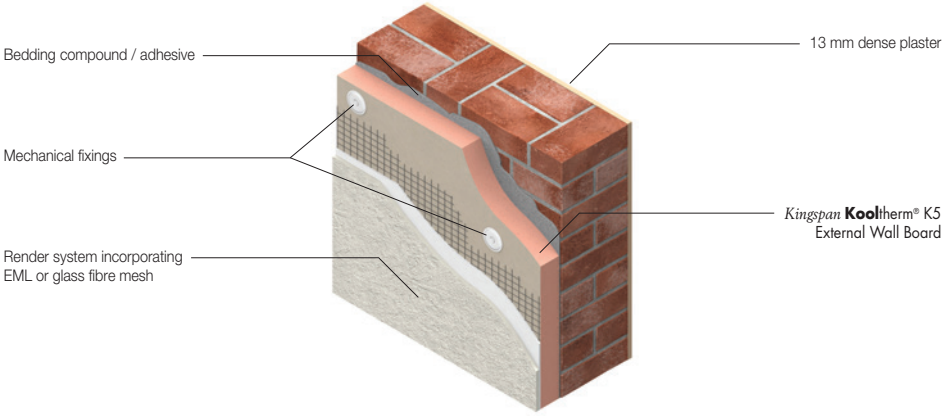
Installation Details – Insulated Render Systems

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- Because insulated render systems are proprietary and utilise different mechanisms for attaching insulation to the wall structure, sitework guidance should be sought from the render system manufacturer. However, in the absence of any other guidance, the instructions laid out below may be followed.
- The external masonry wall should be clean, flat, and free from protrusions.
- Where an uneven surface remains, it is recommended that a bedding compound can be applied prior to fixing the insulation boards.
- External wall insulation should start 150 / 200* mm below the top surface of the ground floor insulation / perimeter insulation upstand (whichever is higher) for a concrete floor, or 200 mm below the top surface of the ground floor insulation / perimeter insulation upstand (whichever is higher) for a suspended timber floor.

  **150 mm applies to Scotland and 200 mm applies to England & Wales*
- Insulation boards should be installed break–bonded, with joints lightly butted.
- Care should be taken to install the specified thickness of insulation around reveals.
- Insulation boards are to be restrained to the substrate with adhesive and mechanical fixings. For further advice please contact the render system provider.
- Boards of *Kingspan* **Kool**therm® K5 External Wall Board are mechanically fixed to the exterior of masonry external walls, preferably using thermally broken telescopic tube fasteners.
- A minimum of 5 fixings are required to secure an insulation board to the masonry wall.
- Board edges at openings and external corners should be fixed with fasteners at minimum 300 mm centres.
- Fasteners at board edges must be located > 50 mm, and < 150 mm, from edges and corners of the board, and not overlap board joints.
- The requirement for additional fixings is dependent on the render system being applied and the type of fixing being used.
- Wherever possible, care should be taken to avoid cold bridging when attaching services and ancillaries to the exterior of the building.
- Depending on the render finish being applied, advice must be sought from the render manufacturer on the EML / glass fibre mesh and bedding mortar to be applied.
- In refurbishment projects, sill extenders and flashings should be used around openings, with care taken to avoid cold bridging.

Masonry Walls
INSULATED RENDER SYSTEMS

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)										
Item	U–values									
	0.15	0.16	0.17	0.18	0.21	0.22	0.25	0.26	0.28	0.30
Dense plaster	13	13	13	13	13	13	13	13	13	13
Brickwork	215	215	215	215	215	215	215	215	215	215
Kingspan **Kool**therm® K5 External Wall Board	120	60+55	55+50	100	85	80	70	65	60	55
Polymer render	10	10	10	10	10	10	10	10	10	10

These calculations assume the use of telescopic tube fasteners with a thermal conductivity of 1.00 W/m·K or less, the effect of which is insignificant.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Timber Frame Systems

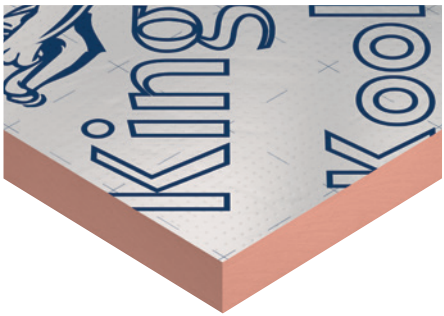
INSULATION BETWEEN STUDS, WITH & WITHOUT INSULATED SHEATHING

Kingspan **Kool**therm® K12 Framing Board

Kingspan **Kool**therm® K12 Framing Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Kool**therm® K12 Framing Board is suitable for use:

- in timber and steel framing systems;
- with insulated plasterboard; and
- for new build and refurbishment.



Fibre-free Core

Product details

- Thermal Conductivity
  – 0.023 W/m·K (insulant thickness < 25 mm)
  – 0.021 W/m·K (insulant thickness 25 – 44 mm)
  – 0.020 W/m·K (insulated thickness ≥ 45 mm)
- Compressive Strength – typically exceeds 100 kPa, 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 – 150 mm (speak to your local merchant or distributor for stocked sizes)

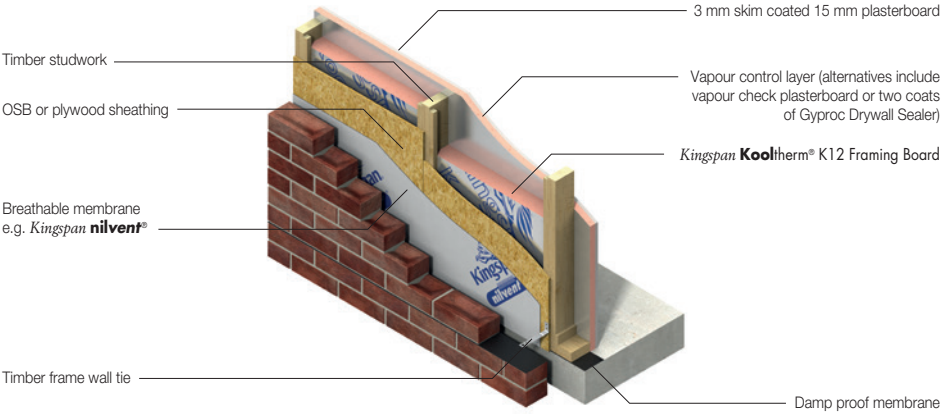
Product benefits

- 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

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- *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, 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.
- In all cases, measure the distance between studs before cutting *Kingspan* **Kool**therm® K12 Framing Board 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



Thickness (mm) of material to achieve U–values (W/m²·K)										
Item	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	32.5	32.5	32.5	32.5	n/a	n/a	n/a	n/a	n/a
Polythene vapour control layer	n/a	n/a	n/a	n/a	n/a	0.5	0.5	0.5	0.5	0.5
Kingspan **Kool**therm® K12 Framing Board between timber studs	120	120	110	100	70	120	90	80	70	60
Timber stud cavity	20	20	30	40	70	20	50	60	70	80
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	102	102	102	102	102	102	102	102	102

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

Timber Frame Systems

INSULATION BETWEEN STUDS, WITH & WITHOUT INSULATED SHEATHING

Installation Details – Insulation between Studs with Insulated Sheathing

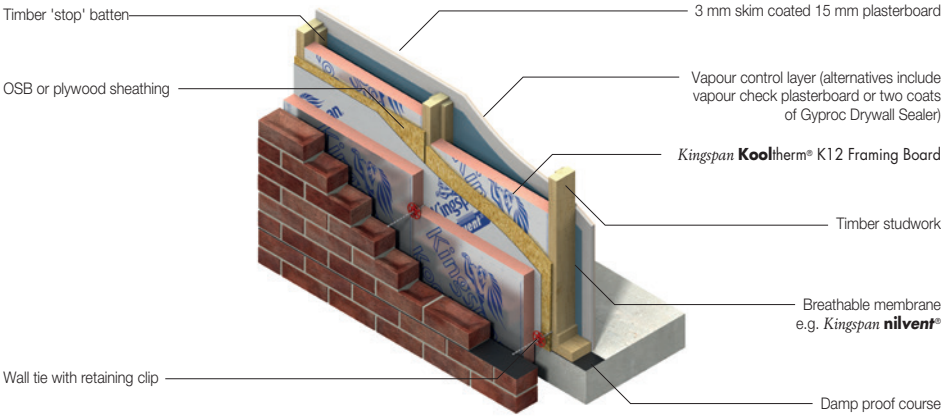
Between Studs

- Please see installation details on page 44.

Insulated Sheathing

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- *Kingspan* **Kool**therm® K12 Framing Board 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.
- 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



Thickness (mm) of material to achieve U–values (W/m²·K)										
Item	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
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	95	40	110	115	120	115	115	120
Kingspan Kooltherm® K12 Framing Board between timber studs	60	50	45	100	30	25	20	25	25	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 Kooltherm® K12 Framing Board	60	50	50	50	40	40	30	25	20	20
Unventilated air cavity	50	50	50	50	50	50	50	50	50	50
Brickwork	102	102	102	102	102	102	102	102	102	102

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

Rainscreen & Masonry Façades

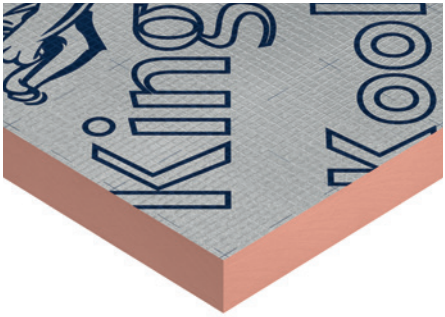
INSULATION FOR RAINSCREEN CLADDING SYSTEMS & MASONRY FAÇADES

Kingspan **Kool**therm® K15 Rainscreen Board

Kingspan **Kool**therm® K15 Rainscreen Board has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a low emissivity composite foil.

Kingspan **Kool**therm® K15 Rainscreen Board is suitable for use:

- for new build and refurbishment.



Fibre-free Core

Product details

- Thermal Conductivity
  – 0.023 W/m·K (insulant thickness 15 – 24 mm)
  – 0.021 W/m·K (insulant thickness 25 – 44 mm)
  – 0.020 W/m·K (insulated thickness ≥ 45 mm)
- Compressive Strength – typically exceeds 100 kPa, 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 – 150 mm (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Achieves European Classification (Euroclass) C-s1,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).
- Easy to handle and install
- First insulation board for use in rainscreen cladding applications to achieve LABC Registered Detail status
- Successfully tested in differing façade systems to BS 8414–1: 2002 & BS 8414–2: 2005, in accordance with the performance criteria set out in BR 135
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- Since rainscreen façade systems are proprietary and use differing mechanisms to fix and support the external cladding to the wall structure, installation guidance should be sought from the system manufacturer or supplier. Nevertheless, in the absence of any other guidance the instructions set out below may be followed.
- Insulation boards should be installed break–bonded with board edges lightly butted and in such a manner to achieve a close fit between the board and substrate interface so as to avoid gaps behind or between the boards.
- Boards should be cut neatly around fixings and brackets, so as to avoid gaps. Where small gaps are unavoidable, fill gaps with fire rated expanding sealant.
- The number and type of mechanical fixings required to fix *Kingspan* **Kool**therm® K15 Rainscreen Board will vary with the geographical location of the building, the local topography, the height and width of the wall concerned, the wall structure, and the type of mechanism being used to attach the cladding system.
- A minimum of 3.13 fixings per m^2 are required to secure the insulation board to the wall structure.
- The requirement for additional fixings should be assessed in accordance with BS / I.S. EN 1991–1-4: 2005 + A1: 2010 (National Annex to Eurocode 1. Actions on structures, General Actions, Wind Actions).
- The fixings should be evenly distributed over the whole area of the board.
- Fixings at board edges must be located > 50 mm and < 150 mm from edges and corners of the board and not overlap board joints.
- The joints of *Kingspan* **Kool**therm® K15 Rainscreen Board should always be taped using a 75 mm (min.) wide suitable self–adhesive aluminium foil tape.
- In the absence of other protection, exposed edges of *Kingspan* **Kool**therm® K15 Rainscreen Board should be protected by a suitable self–adhesive aluminium foil tape, with a 50 mm (min.) wide overlap onto the insulation board face.

Rainscreen & Masonry Façades

INSULATION FOR RAINSCREEN CLADDING SYSTEMS & MASONRY FAÇADES

- For advice on the specification of self–adhesive aluminium foil tape and application guidelines, refer to:

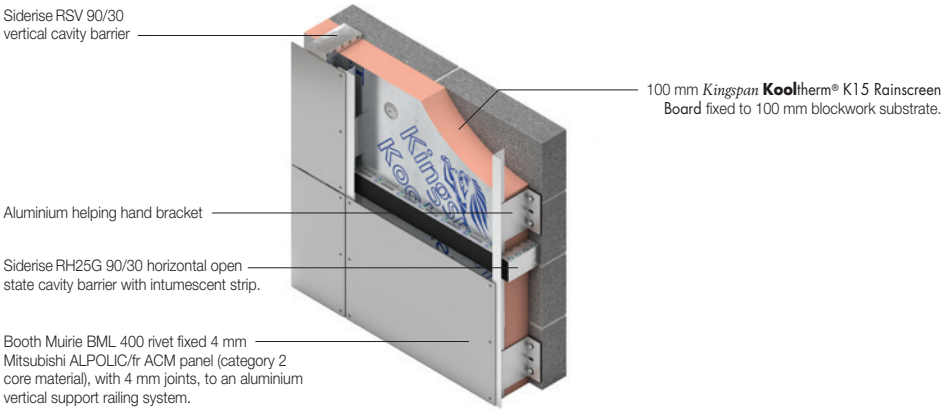
Ejot UK Limited
+44 (0)1977 687 040
www.ejot.co.uk

Fixfast
+44 (0) 1732 882 387
www.fixfast.com

MAK Fasteners
+353 (0) 1 451 99 00
www.makfasteners.com

SFS Intec
+44 (0) 113 2085 500
www.sfsintec.biz/uk

Bostik Limited
+44 (0) 1785 272 727
www.bostik.co.uk



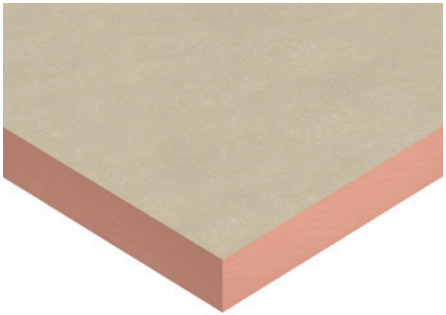
Floors
SOLID CONCRETE & SUSPENDED GROUND FLOOR

Kingspan **Kool**therm® K103 Floorboard

Kingspan **Kool**therm® K103 Floorboard has a premium performance fibre–free rigid thermoset phenolic insulation core faced on both sides with a glass tissue based facing.

Kingspan **Kool**therm® K103 Floorboard is suitable for use:

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



Fibre-free Core

Product details

- Thermal Conductivity – 0.018 W/m·K
- Compressive Strength – typically exceeds 120 kPa, 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 – 150 mm (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Achieves European Classification (Euroclass) B-s2,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).
- Can reduce the cost of related items such as soil removal or relocation of service connections
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP
- BBA certified

Installation Details – Solid Ground Floors – 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.

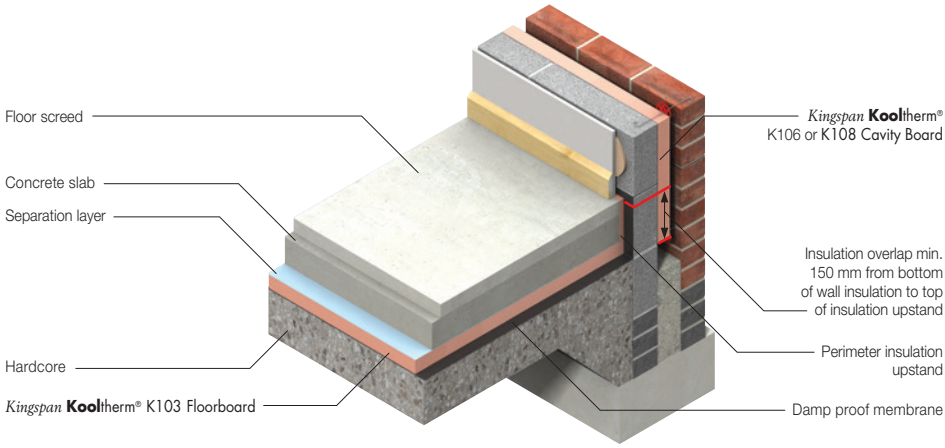
Below Screed

- 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 top 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.

Typical Construction & U-values



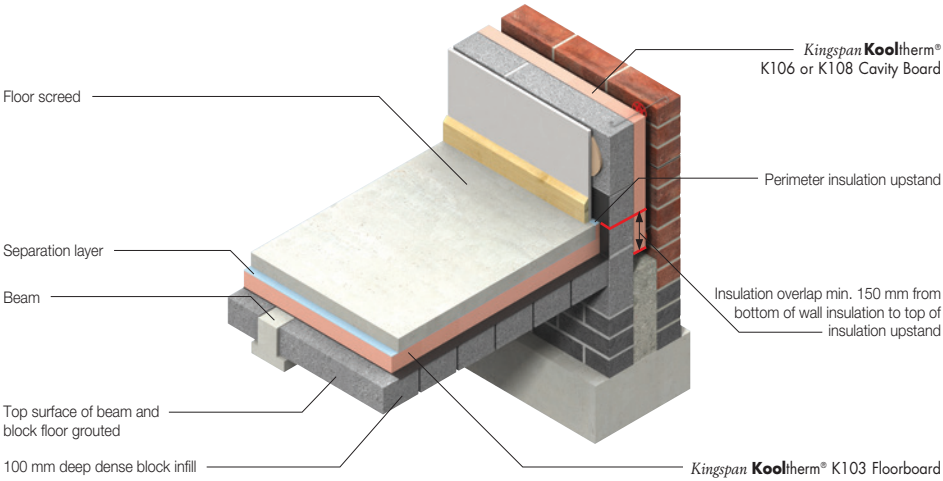
Item	Thickness (mm) of material to achieve U–values (W/m²·K)						
	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Screed	65	65	65	65	65	65	65
Concrete	150	150	150	150	150	150	150
Separation layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan **Kool**therm® K103 Floorboard	140	110	95	75	65	55	45
Damp proof 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 and 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 top 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.

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 **Kool**therm® K103 Floorboard	140	110	95	75	65	60	50
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* **Kool**therm® K103 Floorboard 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.

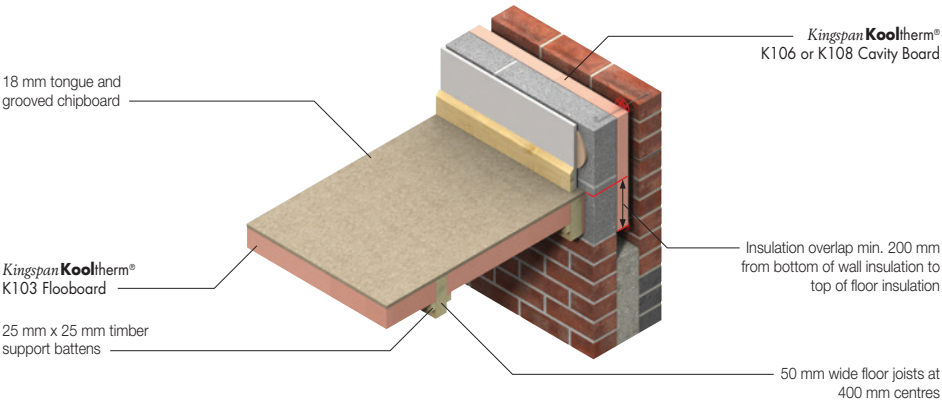
Installation from Below the Floor Joists

- Floor boards should be fixed over joists prior to fitting *Kingspan* **Kool**therm® K103 Floorboard 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.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)							
Item	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
Separation layer	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Kingspan **Kool**therm® K103 Floorboard	120 + 120	100 + 100	80 + 80	130	110	100	80

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.

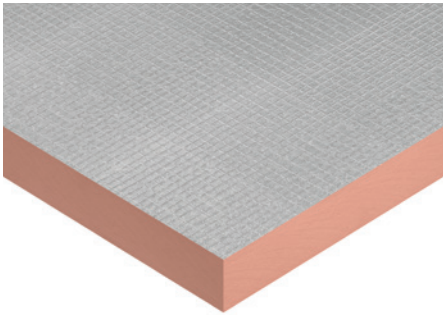
Kingspan **Kool**therm® K110 & *Kingspan* **Kool**therm® K110 **PLUS** Soffit Board

Kingspan **Kool**therm® K110 Soffit Board has a premium performance fibre–free rigid thermoset phenolic insulation core with a glass tissue based inner (concealed) facing and a low emissivity composite foil outer (exposed) facing.

Kingspan **Kool**therm® K110 **PLUS** Soffit Board has a premium performance fibre–free rigid thermoset phenolic insulation core with a glass tissue based inner (concealed) facing and a 6 mm A1 Euroclass building board outer (exposed) facing.

Kingspan **Kool**therm® K110 & *Kingspan* **Kool**therm® K110 **PLUS** Soffit Board are suitable for use:

- for new build and refurbishment.



Fibre-free Core

Product details

- Thermal Conductivity – 0.018 W/m·K
- Compressive Strength – typically exceeds 100 kPa, 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 – 120 mm (*Kingspan* **Kool**therm® K110 Soffit Board) 30 – 120 mm (*Kingspan* **Kool**therm® K110 **PLUS** Soffit Board) (speak to your local merchant or distributor for stocked sizes)

Product benefits

- Resistant to the passage of water vapour
- Easy to handle and install
- Manufactured with a blowing agent that has zero ODP and low GWP

- *Kingspan* **Kool**therm® K110 Soffit Board achieves the following European Classification (Euroclass) results when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests):

Flame Application Position	Euroclass
Inner (concealed) glass tissue based facing	B-s2,d0
Outer (exposed) composite foil facing	B-s1,d0

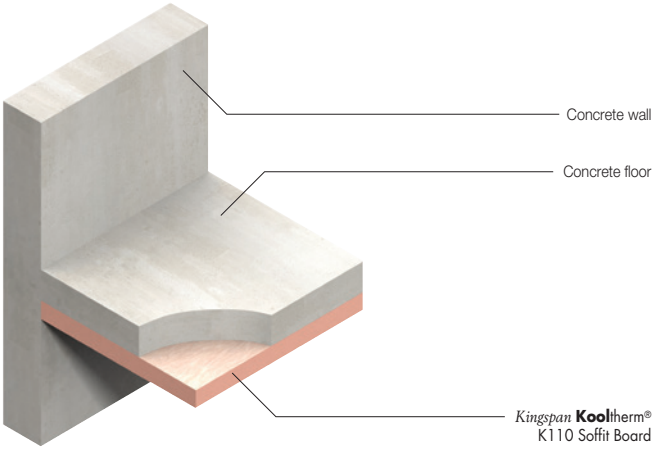
- *Kingspan* **Kool**therm® K110 **PLUS** Soffit Board achieves European Classification (Euroclass) B-s1,d0 when classified to EN 13501-1: 2018 (Fire classification of construction products and building elements. Classification using data from reaction to fire tests).
- For FM approval, please see the full product brochure on the Kingspan Insulation website
- BBA certified (*Kingspan* **Kool**therm® K110 Soffit Board)

Visit www.kingspaninsulation.co.uk for further information

Installation Details

- There are restrictions placed upon this product which vary dependant on building type, height, construction and location. For guidance regarding the routes to compliance for meeting the fire safety requirements of the Building Regulations / Standards, refer to the relevant Technical Bulletins and links to Government websites at www.kingspaninsulation.co.uk/fireregulations.
- Insulation boards should be installed break–bonded, with joints lightly butted.
- The number of mechanical fixings required to fix *Kingspan* **Kool**therm® K110 Soffit Board or *Kingspan* **Kool**therm® K110 **PLUS** Soffit Board will vary with the geographical location of the building, the local topography, the height and width of the soffit concerned, and the soffit construction.
- A minimum of 11 mechanical fixings, with a minimum head diameter of 25 mm, are required to secure the insulation boards to the soffit.
- Where the insulation boards may be subject to external wind pressure, the requirement for additional fixings should be assessed in accordance with BS / I.S. EN 1991–1–4: 2005 (National Annex to Eurocode 1 Actions on Structures. General Actions. Wind Actions).
- The fixings should be evenly distributed over the whole area of the board, and must offer adequate penetration into a solid substrate.
- Fixings at board edges must be located > 50 mm and < 150 mm from edges and corners of the board and not overlap board joints.
- Depending upon the fixing type, insulation boards can also be fitted by a shot fired fixing method which can result in significantly faster installation times. All of the guidance above still applies.

Typical Construction & U-values



Thickness (mm) of material to achieve U–values (W/m²·K)							
Item	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Concrete deck	200	200	200	200	200	200	200
Kingspan **Kool**therm® K110 Soffit Board (packer board)	30	25	25	n/a	n/a	n/a	n/a
Kingspan **Kool**therm® K110 **PLUS** Soffit Board	126	116	96	106	91	81	71

Calculations assume use of thermally broken fixings with a thermal conductivity of 1.00 W/m·K.
NB Speak to your local merchant or distributor for stocked board thicknesses.

Thickness (mm) of material to achieve U–values (W/m²·K)							
Item	U–values						
	0.11	0.13	0.15	0.18	0.20	0.22	0.25
Concrete deck	200	200	200	200	200	200	200
Kingspan **Kool**therm® K110 Soffit Board	85+90	70+60	110	100	85	75	65

Calculations assume use of thermally broken fixings with a thermal conductivity of 1.00 W/m·K.
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 Pentane based 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.

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.

Glossary

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, which 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 as defined in BS EN 826 : 2013 'ratio of the maximum compressive force reached when the strain at yield or rupture is less than 10 %, to the initial cross-sectional area of the test specimen'... in other words, 'the point at which the load causes the insulation to yield before it reaches 10% relative deformation'.

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; and
- 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.

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.

EPD An Environmental Product Declaration (EPD) is the tool used to communicate the outcome of a Life Cycle Analysis concerning the environmental impacts of a building material throughout a product's life cycle.

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.

Glossary

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.

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:

- $k = 10 – 6 \times \Sigma$ (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; or
- 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.

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 Insulation 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, for example *Kingspan* **Therma**pitch®, that has a thermal conductivity of 0.022 W/m·K.

Psi–value or Ψ value is the measure of heat loss per K 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. The *Kingspan* **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.

Glossary

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; and
- 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.

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 the *Kingspan* **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* **GreenGuard**® 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}).

Notes

Notes

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