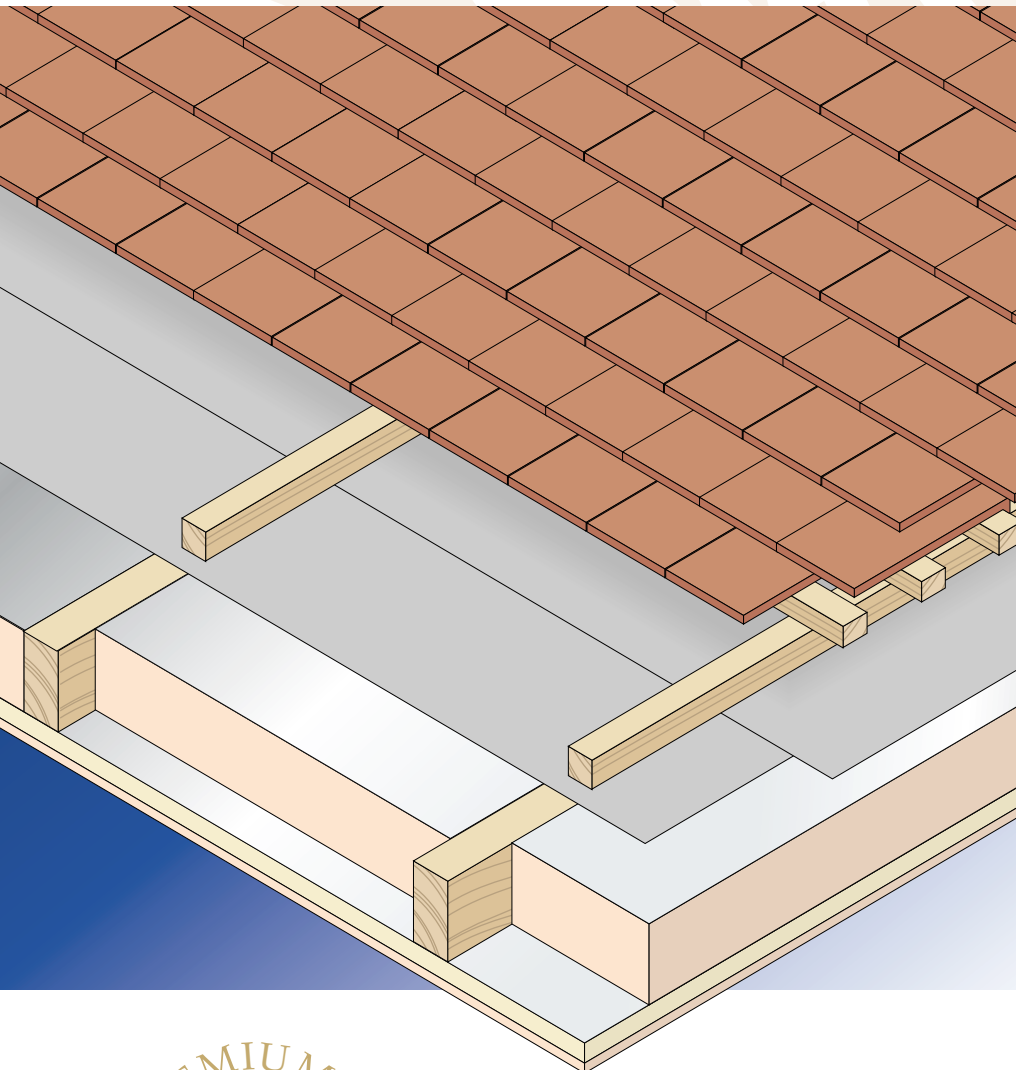


Kooltherm[®] K7 Pitched Roof Board

RAFTER LEVEL INSULATION FOR TILED
OR SLATED PITCHED WARM ROOF SPACES



- ▼ Premium performance rigid phenolic insulation – thermal conductivity 0.018 W/m.K
- ▼ On average its use creates 15% more usable warm roof space
- ▼ Negligible smoke emission
- ▼ Class O fire rating
- ▼ Insulation of pipes and tanks is unnecessary
- ▼ No condensation risk
- ▼ Unaffected by air movement
- ▼ Resistant to the passage of water vapour
- ▼ Easy to handle and install
- ▼ Ideal for newbuild and refurbishment
- ▼ CFC-free



Kingspan **Kooltherm**® K7 Pitched Roof Board

TYPICAL DESIGN DETAILS

FIGURE 1 UNVENTILATED INSULATION BETWEEN & UNDER RAFTERS (Recommended for new build or re-roofing)

Figure 1a FULLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD

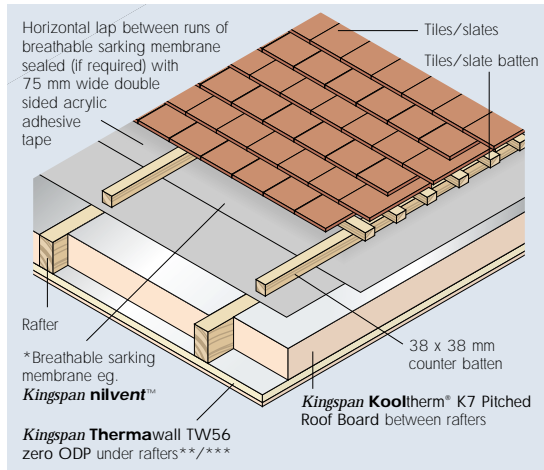


Figure 1c FULLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD

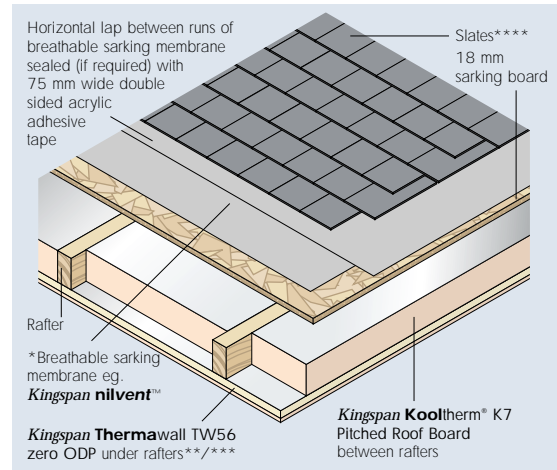


Figure 1b PARTIALLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD

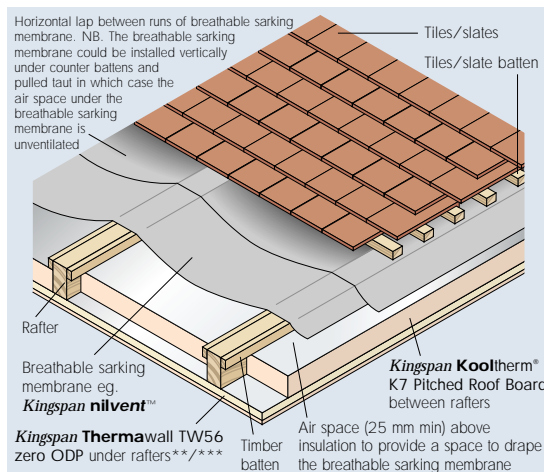


Figure 1d PARTIALLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD

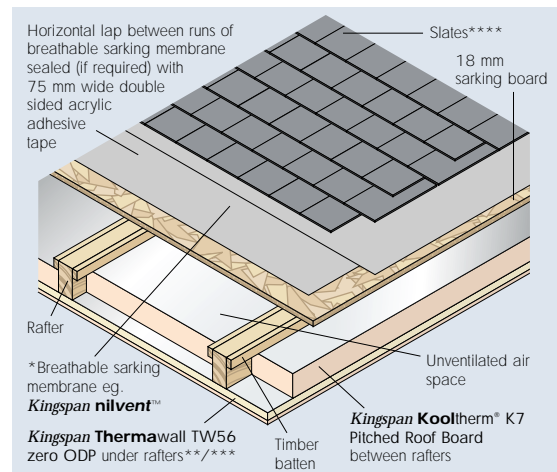


FIGURE 2 VENTILATED INSULATION BETWEEN & UNDER RAFTERS (Recommended for loft conversion)

Figure 2a NO SARKING BOARD

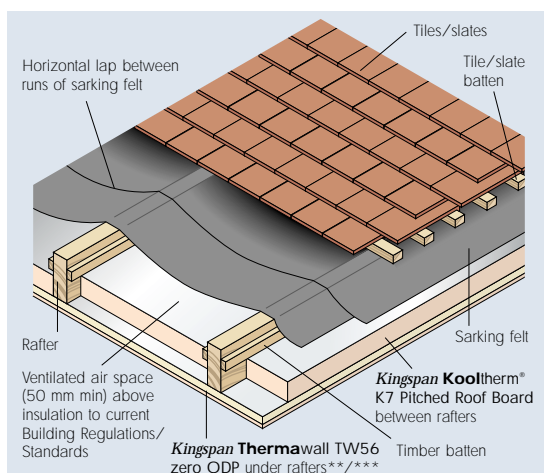


Figure 2b 18 mm SARKING BOARD

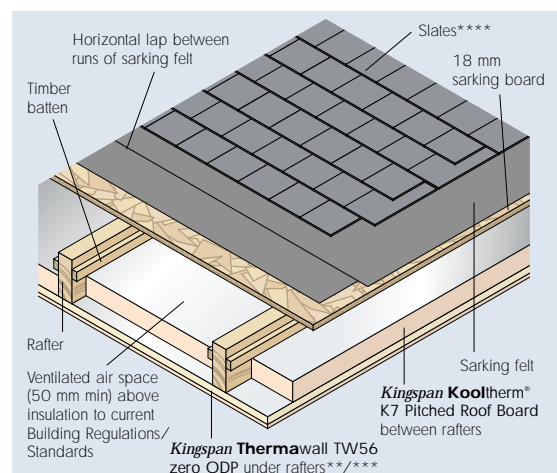


FIGURE 3 UNVENTILATED INSULATION BETWEEN RAFTERS
(Recommended for new build or re-roofing)

Figure 3a FULLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD

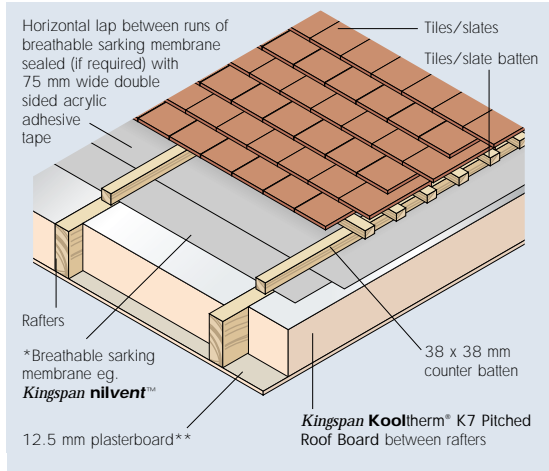


Figure 3c FULLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD

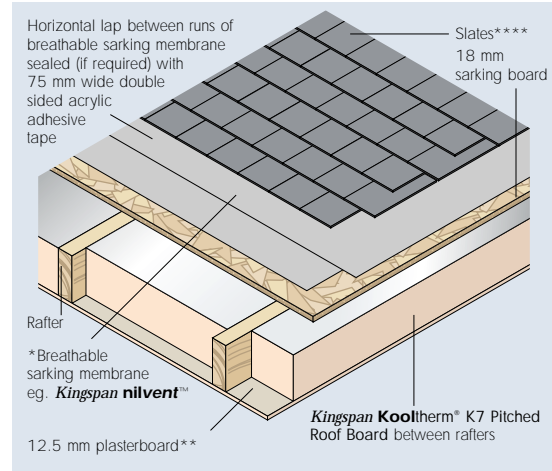


Figure 3b PARTIALLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD

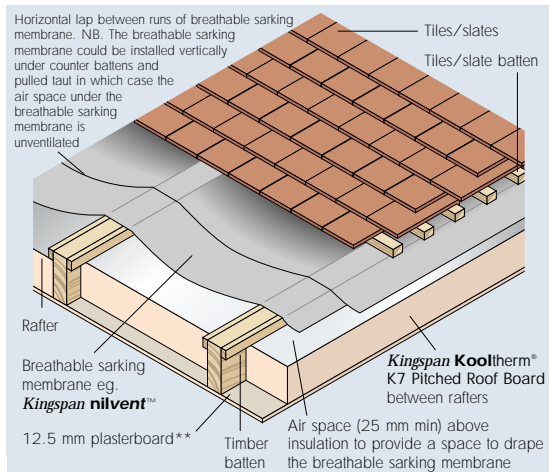


Figure 3d PARTIALLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD

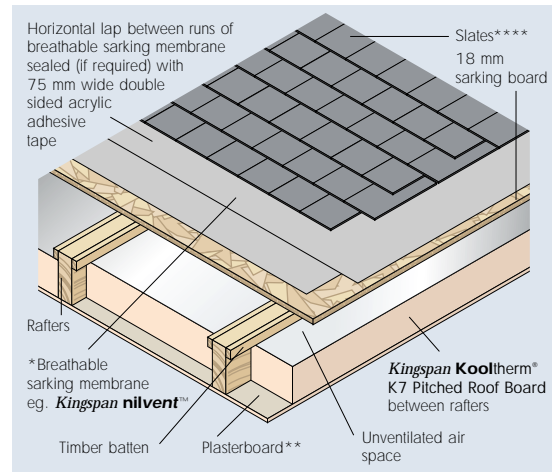


FIGURE 4 VENTILATED INSULATION BETWEEN RAFTERS
(Recommended for loft conversion)

Figure 4a NO SARKING BOARD

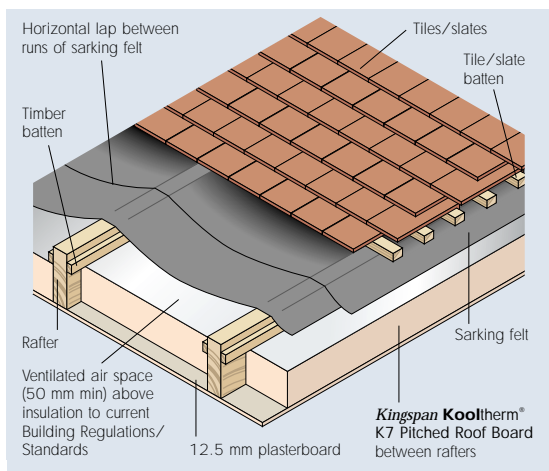
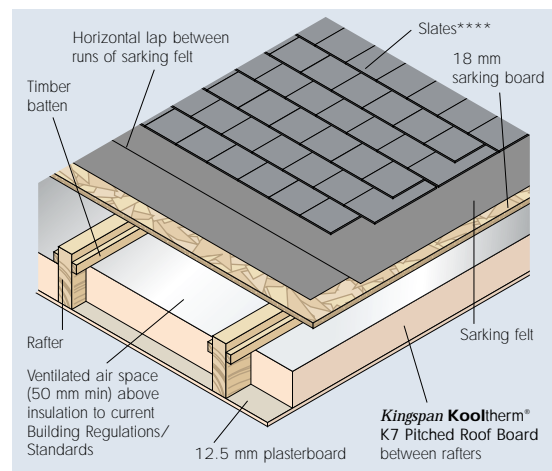


Figure 4b 18 mm SARKING BOARD



Kingspan **Kooltherm**® K7 Pitched Roof Board

FIGURE 5 UNVENTILATED INSULATION BETWEEN & OVER RAFTERS (Recommended for new build or re-roofing)

Figure 5a NO SARKING BOARD

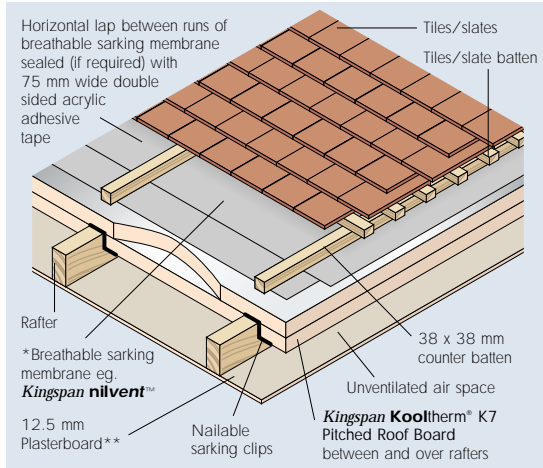


Figure 5b 18 mm SARKING BOARD

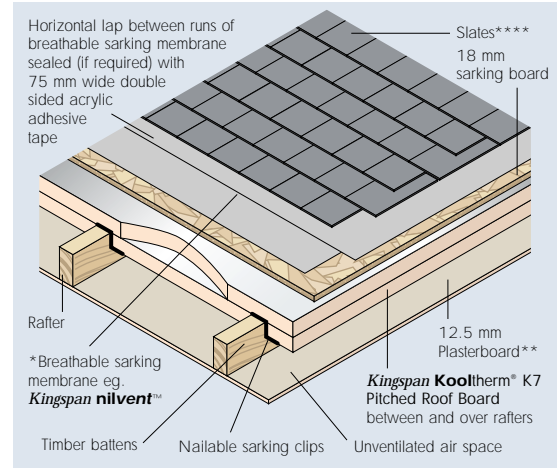


FIGURE 6 UNVENTILATED INSULATION OVER RAFTERS (Recommended for new build or re-roofing)

Figure 6a NO SARKING BOARD

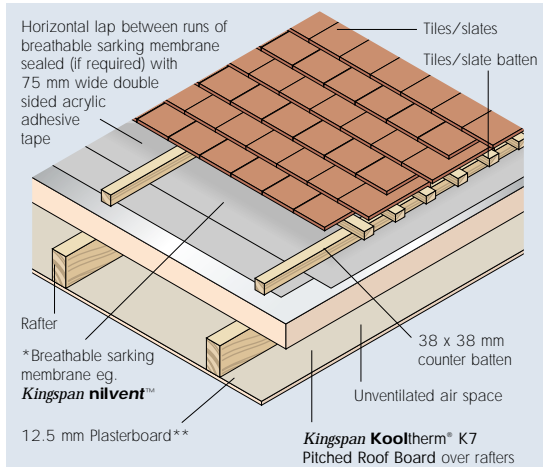
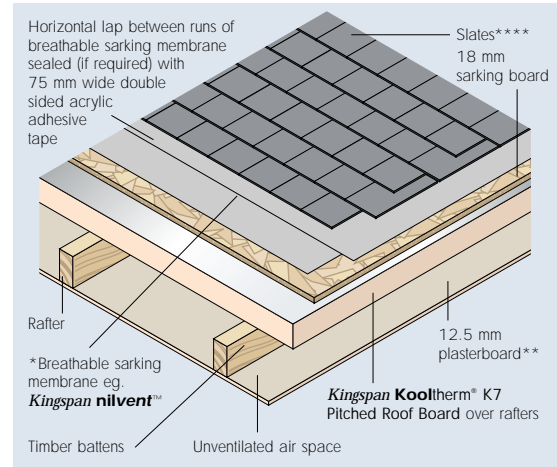


Figure 6b 18 mm SARKING BOARD



- * The breathable sarking membrane can be placed over the counter battens, draped to provide for drainage and overlain with tile/slate battens. This will yield a marginally better U-value but it will be more difficult to seal the breathable sarking membrane effectively.
- ** The requirement for a vapour control layer and/or under tile ventilation should be assessed to BS 5250: 1989 (1995). Vapour check plasterboard or a separate vapour control layer can be used as preferred.
- *** **Kingspan Thermawall TW56** zero ODP contains an integral vapour control layer.
- **** If tiles are to be used then this normally necessitates the use of counter battens and tiling battens over the breathable sarking membrane to allow for water drainage and attachment of the tiles.

SPECIFICATION CLAUSE

Kingspan Kooltherm® K7 Pitched Roof Board should be described in specifications as:-

The rafter level insulation shall be **Kingspan Kooltherm**® K7 Pitched Roof Board ___mm thick comprising a CFC-free rigid phenolic insulation core with low emissivity composite foil facings on both sides manufactured to BS EN ISO 9002: 1994 by Kingspan Insulation Limited and shall be applied in accordance with the instructions issued by them.

Details also available in NBS PLUS. NBS users should refer to clause K11 695.



DESIGN CONSIDERATIONS

UNVENTILATED (SEALED AND UNSEALED) AND VENTILATED CONSTRUCTIONS

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

Recent research suggests that the unventilated, sealed roof approach yields a more energy efficient roof as the impacts of ventilation and incidental infiltrating cold air are negated.

POSITION OF INSULATION

Dependent on the designed insulation value of the construction and the available rafter depth and headroom, different approaches can be taken. It may be necessary to use two layers of insulation to achieve required U-values e.g. Figures 1, 2 & 5. An additional benefit of two layer systems and the Insulation Over Rafter approach (see Figure 1, 2, 5 & 6) is that thermal bridging caused by the rafter is prevented and the potential for pattern staining in the position of the rafters is completely avoided. The choice may be influenced by the available headroom and concerns over the depth of bargeboards.

Approaches with a layer of insulation over rafter are likely to yield very tall fascia boards and so generally, between and under rafter insulation approaches are probably more desirable e.g. (Figures 1 and 2).

Note: However, where the choice is for two layers, the layer with the greatest effective R-value should be placed uppermost in order to prevent condensation between the two layers.

UNVENTILATED ROOF - VENTILATION CONSIDERATIONS

Unventilated roof approaches create a warm pitched roof space, which does not require cross ventilation. Recent research suggests that sealing an unventilated roof, yields a more energy efficient roof as the impacts of ventilation and incidental infiltrating cold air are negated. Therefore, if creating an unventilated roof, it is preferable to fully seal all joints in the breathable sarking membrane with tape. 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 breather membrane manufacturer.

The requirement for a vapour control layer and / or under-tile ventilation should be assessed to BS 5250: 1989 (1995) (Code of practice for control of condensation in buildings). Vapour check plasterboard or a separate vapour control layer can be specified, as preferred if required.

Note: *Kingspan Thermawall TW56* zero ODP, as used in Figure 1, contains an integral vapour control layer.

VENTILATED ROOF - VENTILATION CONSIDERATIONS

In these cases the Building Regulations /Standards require a 50mm 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: 1989 (1995) (Code of practice for control of condensation in buildings). Vapour check plasterboard or a separate vapour control layer can be specified, as preferred if required.

Note: *Kingspan Thermawall TW56* zero ODP, as used in Figure 2, contains an integral vapour control layer.

BREATHABLE SARKING MEMBRANE

BS 5250: 1989 (1995) (Code of practice for control of condensation in buildings) recommends that the vapour resistance of the breathable sarking membrane e.g. *Kingspan nilvent*TM must not exceed 0.25 MN.s/g.

POSITION OF BREATHABLE SARKING MEMBRANE

The taping of breathable sarking membrane joints is considerably easier to achieve if the membrane is installed on a continuous surface (Figures 1a, 1c, 1d, 3a, 3c, 3d, 5a, 5b, 6a & 6b).

In these cases, the breathable sarking membrane is installed under the counter battens, which provide a channel for water drainage, or in situations with a sarking board under a slated roof, 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 some cases with a continuous surface (Figure 1a, 3a, 5a & 6a, and 1c, 1d, 3c, 3d, 5b & 6b when counter battens, tiling battens and tiles replace slates nailed directly into the sarking board) the breathable sarking membrane can be installed over the counter battens. This yields a marginally better design U-value but it may be more difficult to seal the breathable sarking membrane joints effectively, as the membrane must be draped over the counter battens in horizontal runs so as to provide a water drainage channel. The air movement allowed by the unsealed membrane may negate the benefit of putting the membrane above the counter battens.

In situations where there is no continuous surface (Figures 1b and 3b), the breathable sarking membrane can be draped over the rafters in horizontal runs to provide a channel for water drainage. In this situation, sealing of the breathable sarking membrane joints will prove difficult.

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 counterbattens placed over the laps in rafter positions. The breathable sarking membrane is installed taut as the counterbatten 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 counterbattens with laps sealed (Figures 1a, 1c and 1d).

Kingspan **Kooltherm**® K7 Pitched Roof Board

The next best solution is, therefore, between and under rafter insulation with no continuous surface for the breathable sarking membrane, and the breathable sarking membrane installed in vertical runs with laps sealed under counterbattens (Figure 1b).

MANSARD ROOFS/WALLS

Kingspan Kooltherm® K7 Pitched Roof Board can be used for the construction of insulated tiled or slated mansard roofs / walls. Its application on such contracts is identical to the standard specification, which is given here.

FIRE STOPS

Current Building Regulations / Standards should be considered with regard to the requirements for and/or provision of fire stops.

THERMAL PROPERTIES

THERMAL CONDUCTIVITY

The boards achieve a thermal conductivity (λ -value) of 0.018 W/m.K.

THERMAL RESISTANCES

Thermal resistance (R-value) varies with thickness and is calculated by dividing the thickness of the board (expressed in metres) by its thermal conductivity.

Insulant Thickness (mm)	Thermal Resistance (m ² .K/W)
20	1.111
25	1.389
30	1.667
35	1.944
40	2.222
45	2.500
50	2.778
55	3.056
60	3.333
65	3.611
70	3.889

TYPICAL U-VALUES

The U-value requirements as detailed in the appropriate Building Regulations/Standards can be easily achieved utilising the appropriate thickness of **Kingspan Kooltherm**® K7 Pitched Roof Board. The calculation of U-values for pitched roof insulation purposes is determined by a number of factors:

- will the loft space be habitable or not;
- does the ceiling line follow the pitch of the roof or is it a flat horizontal ceiling;
- the pitch of the roof (where a horizontal ceiling is to be used); and
- rafter centres/depth/width where insulation is between rafters.

The following examples have been calculated using both the combined method and the proportional area method. The combined method is required for compliance with Building Regulations / Standards revised after the year 2000. These examples are based on the constructions shown in Figures 1 to 6 with 50 mm wide rafters at 600 mm centres and 12.5 mm plasterboard. If your construction is any different, please consult our Technical Services Department (see rear cover).

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

Proportional Area Method – U-values were calculated using the method detailed in The Chartered Institute of Building Services Engineers (CIBSE) Guide A3 (Thermal Properties of Building Structures).

NB when calculating U-values using the combined method as detailed in BS / IS EN ISO 6946: 1997, the type of mechanical fixing used may change the thickness of insulation required. The effect of fixings has been ignored for the purposes of these calculations. Please contact the Kingspan Insulation Technical Services Department (see rear cover) for project calculations.

NB for the purposes of these calculations the standard of workmanship has been assumed good and therefore the correction factor for air gaps has been ignored.

The figures below are for guidance only. A detailed U-value calculation together with a condensation risk analysis should be completed for each individual project. Please call our Technical Services Department for assistance (see rear cover).

UNVENTILATED INSULATION BETWEEN & UNDER RAFTERS

FULLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD (Fig 1a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
25+50*	0.22	0.21
50+50*	0.18	0.16

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, second thickness outer layer. The thermal resistance of the outer layer must be \geq that of the inner layer so as to avoid condensation. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component.

FULLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD (Fig 1c)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
25+50*	0.22	0.20
50+50*	0.18	0.16

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, second thickness outer layer. The thermal resistance of the outer layer must be \geq that of the inner layer so as to avoid condensation. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component.
NB the thermal resistance of the between rafter layer must be \geq that of the under rafter layer so as to avoid condensation.

PARTIALLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD (Fig 1b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
≤ 25	†	†
30	0.33	0.31
40	0.29	0.27
50	0.26	0.24
55	0.25	0.23
60	0.24	0.22
70	0.22	0.20
40+40*	0.20	0.18
45+45*	0.18	0.17

*Multiple layers required between rafters as maximum thickness exceeded. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component. Calculations assume that there is a minimum 25 mm airspace between the rafters above the insulation layer installed between them.

PARTIALLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD (Fig 1d)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
≤ 25	†	†
30	0.32	0.30
35	0.30	0.28
40	0.29	0.27
45	0.27	0.25
50	0.26	0.24
60	0.23	0.21
70	0.21	0.20
25+50*	0.20	0.19
45+45*	0.18	0.17

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, second thickness outer layer. The thermal resistance of the outer layer must be \geq that of the inner layer so as to avoid condensation. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component. Calculations assume that there is a minimum 25 mm airspace between the rafters above the insulation layer installed between them.

VENTILATED INSULATION BETWEEN & UNDER RAFTERS

NO SARKING BOARD (Fig 2a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
≤ 25	†	†
30	0.36	0.31
35	0.34	0.29
40	0.32	0.27
45	0.30	0.25
50	0.28	0.24
55	0.27	0.23
60	0.25	0.22
70	0.23	0.20
40+40*	0.21	0.18
40+50*	0.19	0.17
50+50*	0.18	0.16

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, second thickness outer layer. The thermal resistance of the outer layer must be \geq that of the inner layer so as to avoid condensation. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component. Calculations assume that there is a minimum 50 mm ventilated airspace between the rafters above the insulation layer installed between them.

18 mm SARKING BOARD (Fig 2b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
≤ 25	†	†
30	0.36	0.30
35	0.34	0.28
40	0.32	0.26
45	0.30	0.24
50	0.28	0.23
55	0.27	0.22
60	0.25	0.21
70	0.23	0.19
40+40*	0.21	0.18
40+50*	0.19	0.17
50+50*	0.18	0.15

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, second thickness outer layer. The thermal resistance of the outer layer must be \geq that of the inner layer so as to avoid condensation. The thermal resistance of the innermost between rafter layer must also be \geq that of the under rafter layer so as to avoid condensation.
NB calculations based on rafters being underlined with **Kingspan Thermawall TW56 zero ODP** comprising 12.5 mm plasterboard and 25 mm of insulation of thermal conductivity 0.022 W/m.K. Thickness shown in the table above is only the between rafter component. Calculations assume that there is a minimum 50 mm ventilated airspace between the rafters above the insulation layer installed between them.

† Although 20 and 25 mm **Kingspan Kooltherm K7 Pitched Roof Board** is available, its effective R-value is \leq that of the insulated plasterboard under the rafters. This carries a potential condensation risk.

Kingspan **Kooltherm**® K7 Pitched Roof Board

UNVENTILATED INSULATION BETWEEN RAFTERS

FULLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD (Fig 3a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
25+50*	0.31	0.31
50+50*	0.24	0.24
60+65*	0.20	0.20
50+50+50*	0.17	0.17

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.

FULLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD (Fig 3c)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
25+50*	0.31	0.30
50+50*	0.24	0.23
60+65*	0.20	0.19
50+50+50*	0.17	0.16

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.

PARTIALLY FILLED INSULATION BETWEEN RAFTERS - NO SARKING BOARD (Fig 3b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
40	0.44	0.41
50	0.38	0.35
60	0.33	0.31
70	0.30	0.27
25+60*	0.25	0.24
55+60*	0.20	0.19
60+70*	0.18	0.17

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.
NB calculations assume that there is a minimum 25 mm airspace between the rafters above the insulation layer installed between them.

PARTIALLY FILLED INSULATION BETWEEN RAFTERS - 18 mm SARKING BOARD (Fig 3d)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
40	0.43	0.40
50	0.37	0.34
55	0.35	0.32
60	0.33	0.30
70	0.29	0.27
40+45*	0.25	0.23
50+60*	0.20	0.19
60+65*	0.18	0.17

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.
NB calculations assume that there is a minimum 25 mm airspace between the rafters above the insulation layer installed between them.

VENTILATED INSULATION BETWEEN RAFTERS

NO SARKING BOARD (Fig 4a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
40	0.52	0.41
50	0.43	0.35
55	0.40	0.33
60	0.37	0.31
70	0.33	0.27
40+40*	0.29	0.25
50+50*	0.24	0.21
60+60*	0.20	0.18

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.
NB calculations assume that there is a minimum 50 mm ventilated airspace between the rafters above the insulation layer installed between them.

18 mm SARKING BOARD (Fig 4b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
40	0.52	0.40
50	0.43	0.35
55	0.40	0.32
60	0.37	0.30
70	0.33	0.27
40+40*	0.29	0.24
50+50*	0.24	0.20
60+60*	0.20	0.17

*Multiple layers required between rafters as maximum thickness exceeded. First thickness refers to inner layer, last thickness to outer layer. The thermal resistance of each layer must be \geq that of the inner layer immediately inside of it so as to avoid condensation.
NB calculations assume that there is a minimum 50 mm ventilated airspace between the rafters above the insulation layer installed between them.

**UNVENTILATED
INSULATION BETWEEN & OVER RAFTERS**

NO SARKING BOARD (Fig 5a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
20+20	0.38	0.36
20+25	0.34	0.33
25+30	0.30	0.29
35+35	0.24	0.23
40+45	0.20	0.19
50+50	0.18	0.17

NB first thickness refers to thickness between rafters, second thickness over rafters. The thermal resistance of the over rafter layer must be ≥ that of the between rafter layer so as to avoid condensation.

18 mm SARKING BOARD (Fig 5b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
20+20	0.38	0.36
20+25	0.34	0.32
25+30	0.29	0.28
35+35	0.24	0.23
45+50	0.20	0.19
50+50	0.18	0.17

NB first thickness refers to thickness between rafters, second thickness over rafters. The thermal resistance of the over rafter layer must be ≥ that of the between rafter layer so as to avoid condensation.

**UNVENTILATED
INSULATION OVER RAFTERS**

NO SARKING BOARD (Fig 6a)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
30	0.42	0.42
40	0.34	0.34
50	0.29	0.29
60	0.25	0.25
70	0.22	0.22

NB combined method calculation accounts for the effect of using a stainless steel fixing of 6.0 mm diameter, giving a cross sectional area of 7.45 mm².
NB greater insulation thicknesses than shown are not available as a single layer and multi-layer insulation is not recommended in over rafter applications.

18 mm SARKING BOARD (Fig 6b)

Insulant Thickness (mm)	U-value (W/m ² .K)	
	Combined Method	Proportional Area Method
30	0.42	0.42
40	0.34	0.34
50	0.29	0.29
60	0.25	0.25
70	0.22	0.22

NB combined method calculation accounts for the effect of using a stainless steel fixing of 6.0 mm diameter, giving a cross sectional area of 7.45 mm².
NB greater insulation thicknesses than shown are not available as a single layer and multi-layer insulation is not recommended in over rafter applications.

Kingspan **Kooltherm**[®] K7 Pitched Roof Board

SITWORK

OVER RAFTER LAYER OF INSULATION

Over rafter insulation without a sarking board (Figures 5a & 6a), is simply fixed by placing the **Kingspan Kooltherm**[®] K7 Pitched Roof Boards over the rafters and under 38 x 38 mm treated softwood counter-battens in line with the rafters. Secure the counter-battens to the rafters by fixing through both the counter-battens and the **Kingspan Kooltherm**[®] K7 Pitched Roof Board.

Over rafter insulation with slates fixed directly into a sarking board (Figures 5b & 6b), is simply fixed by placing the **Kingspan Kooltherm**[®] K7 Pitched Roof Boards over the rafters with the sarking board overlaid. Secure the sarking board and **Kingspan Kooltherm**[®] K7 Pitched Roof Board to the rafters by fixing through both the sarking board and the **Kingspan Kooltherm**[®] K7 Pitched Roof Board.

Over rafter insulation with a sarking board and tiles on tiling battens and counter battens, is simply fixed by placing the **Kingspan Kooltherm**[®] K7 Pitched Roof Boards over the rafters with the sarking board overlaid, and with 38 x 38 mm softwood treated counter-battens in line with the rafters. Secure the counter-battens to the rafters by fixing through the counter-batten, the sarking board and the **Kingspan Kooltherm**[®] K7 Pitched Roof Board.

Kingspan Kooltherm[®] K7 Pitched Roof Boards should be tightly butted, they may be laid either across or down the line of the rafters and should preferably be laid break bonded in order to help improve the racking strength of the roof. All board joints running from eaves to ridge must occur over rafters. There is no necessity to tape board joints. A preservative treated stop rail should be secured to the rafters close to the eaves (see Figures 9a & 9b).

BETWEEN RAFTER LAYER OF INSULATION

Between rafter insulation can be installed by three methods.

In cases where the insulation between rafters is to be flush with the top of the rafters but does not fill the full rafter depth (Figure 5), install the insulation by the use of nailable sarking clips. The nailable sarking clips are driven into the upper surface of each rafter at one-metre intervals up the roof slope. The nailable sarking clips then support lengths of **Kingspan Kooltherm**[®] K7 Pitched Roof Board suitably trimmed to size and placed between the rafters.

In cases where the insulation between rafters is to be flush with the bottom of the rafters but does not fill the full rafter depth (Figures 1b, 1d, 2a, 2b, 3b, 3d, 4a & 4b), install the insulation with the aid of battens nailed to the side of the rafters. The battens should be in the appropriate position to ensure the insulation is flush with the bottom of the rafters.

In cases where the insulation between rafters fully fills the rafter depth (Figures 1a, 1c, 3a & 3c), simply install the correct thickness of insulation in such a manner that it is flush with the bottom of the rafters.

In all cases, ensure that insulation boards are tightly butted and that there is a tight fit between the insulation and the rafters. Fill all gaps with expanding urethane sealant.

UNDER RAFTER LAYER OF INSULATION

Please refer to literature for **Kingspan Thermawall TW56 zero ODP**.

BREATHABLE SARKING MEMBRANE

The specified breathable sarking membrane (e.g. **Kingspan nilvent**[™]) is applied as specified. Application advice should be sought from the appropriate membrane manufacturer.

SARKING FELT

In cases without a sarking board, the sarking felt is draped over the rafters to provide a channel for water drainage and held in place by the slate / tile battens, which are nailed through the felt to the rafters.

In cases with a sarking board, the sarking felt is applied over the sarking board and held in place by the slates or counter battens which are nailed through the felt to the sarking board.

SLATING AND TILING

Slating and tiling over **Kingspan Kooltherm**[®] K7 Pitched Roof Board is exactly the same as on any other pitched roof except that in some instances the slate / tile battens are fixed to the previously applied counter-battens. It is, however, essential that slate or tiling rubble does not lay in contact with the breathable sarking membrane (if used) as this may allow wind driven rain or melted snow to penetrate the breathable sarking membrane.

SURFACE TREATMENT

Kingspan Kooltherm[®] K7 Pitched Roof Board have a foil faced durable surface and no further treatment is necessary. **Kingspan Kooltherm**[®] K7 Pitched Roof Board is not intended to provide an internal finish and should be underlined with a suitable building board.

CUTTING

Cutting should be carried out using a fine toothed saw or by scoring with a knife and snapping the board over a straight edge and cutting the facing on the other side. Ensure accurate trimming to achieve close butting joints and continuity of insulation.

**UNVENTILATED
INSULATION BETWEEN & UNDER RAFTERS OR JUST BETWEEN RAFTERS
(Recommended for new build or re-roofing)**

Figure 7a OVERHANGING EAVES DETAIL - SECTION PERPENDICULAR TO RIDGE

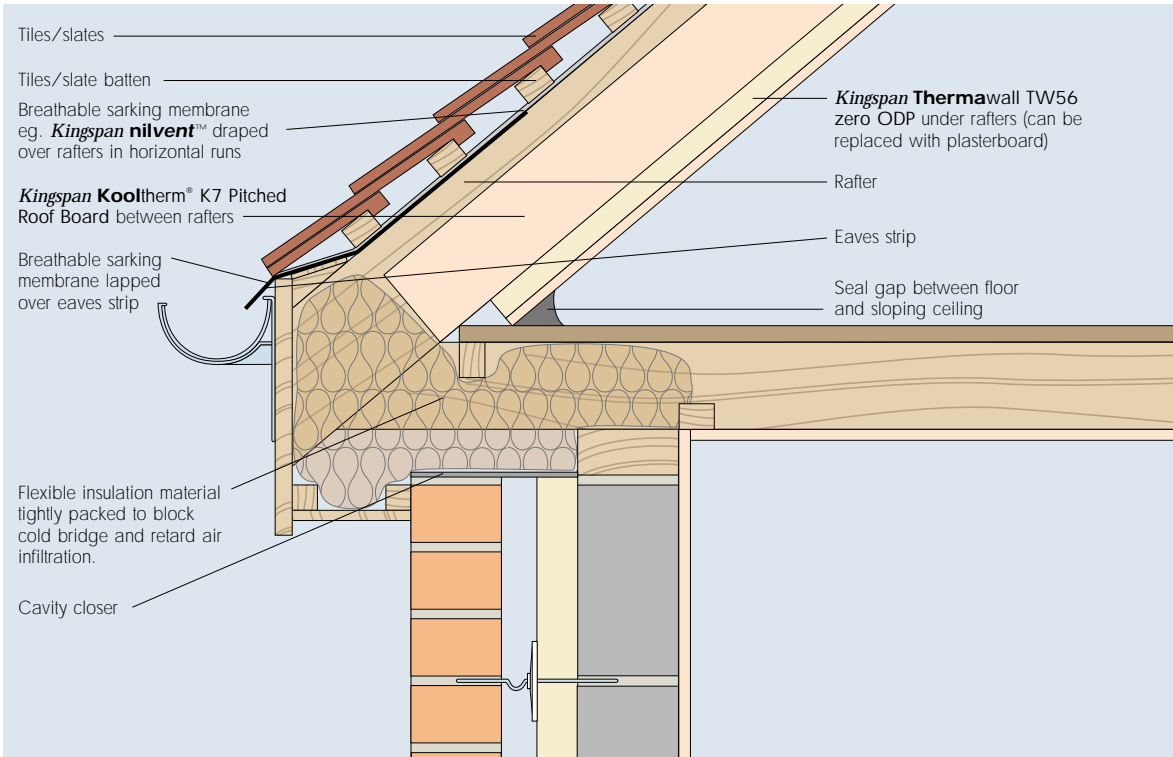
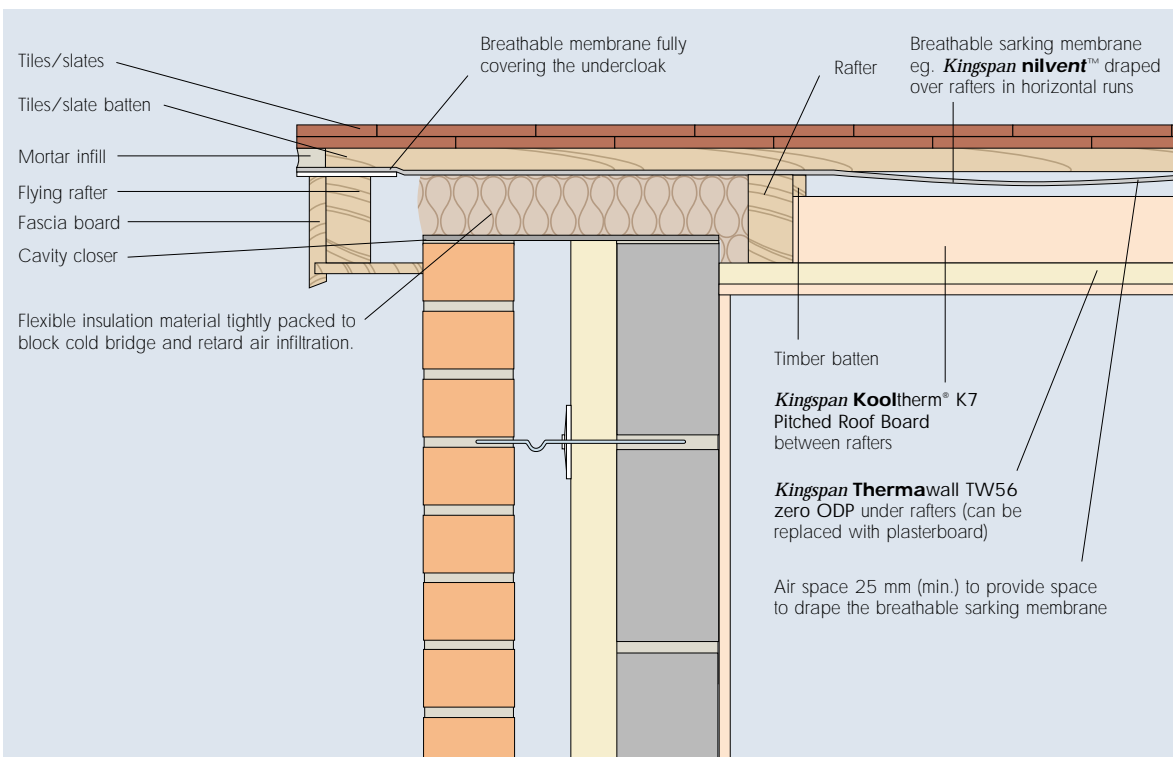


Figure 7b SECTION PARALLEL TO RIDGE



Kingspan **Kooltherm**® K7 Pitched Roof Board

VENTILATED INSULATION BETWEEN & UNDER RAFTERS OR JUST BETWEEN RAFTERS (Recommended for loft conversion)

Figure 8a OVERHANGING EAVES DETAIL - SECTION PERPENDICULAR TO RIDGE

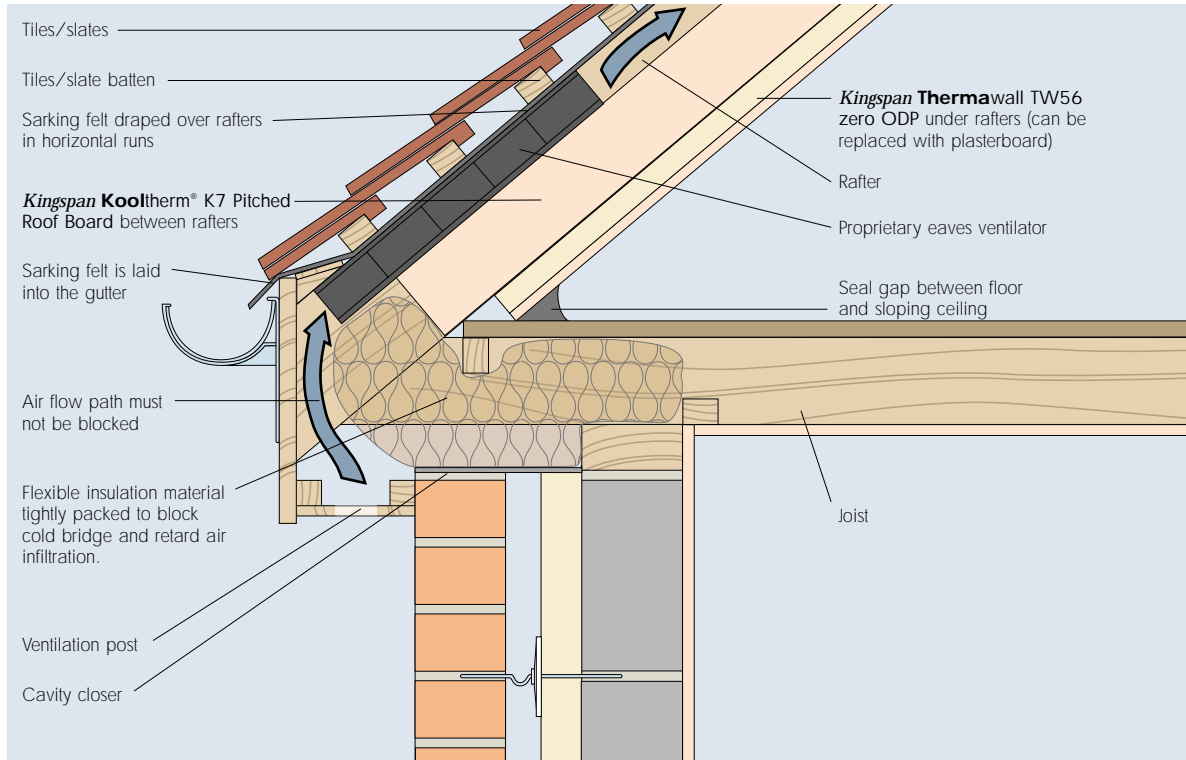
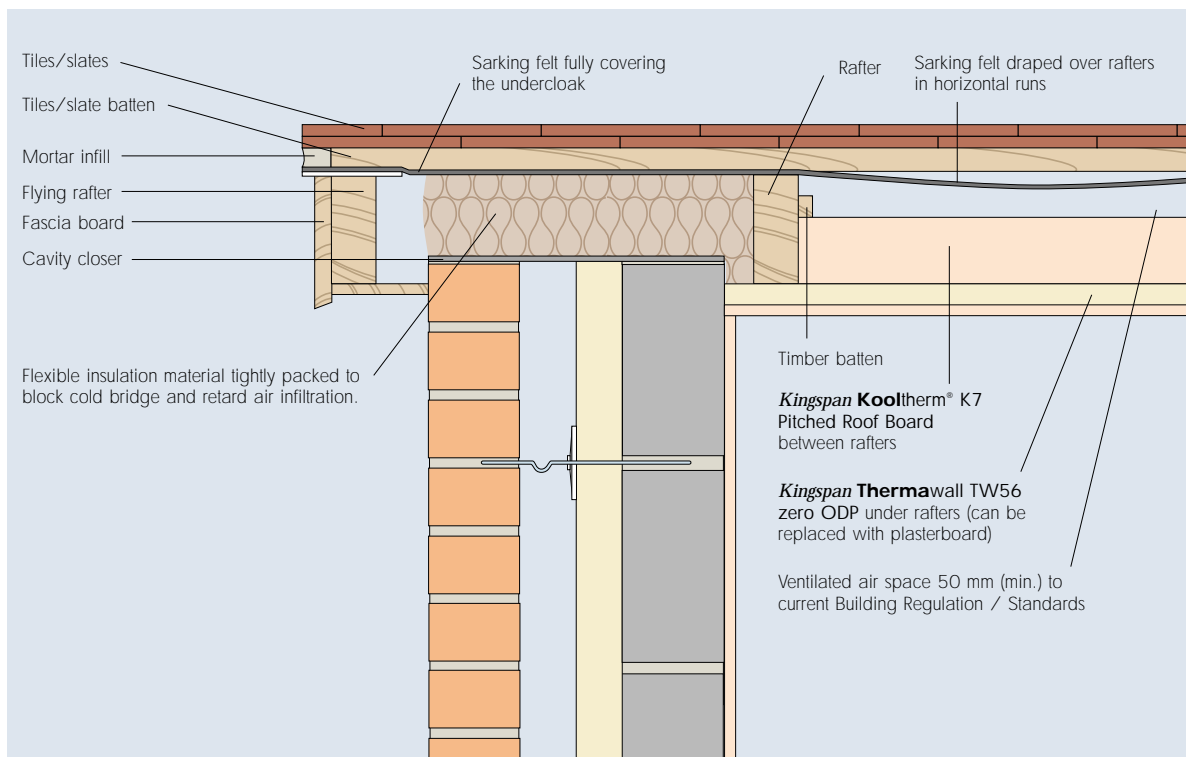


Figure 8b SECTION PARALLEL TO RIDGE



**UNVENTILATED
INSULATION BETWEEN & OVER RAFTERS OR JUST OVER RAFTERS
(Recommended for new build or re-roofing)**

Figure 9a OVERHANGING EAVES DETAIL - SECTION PERPENDICULAR TO RIDGE

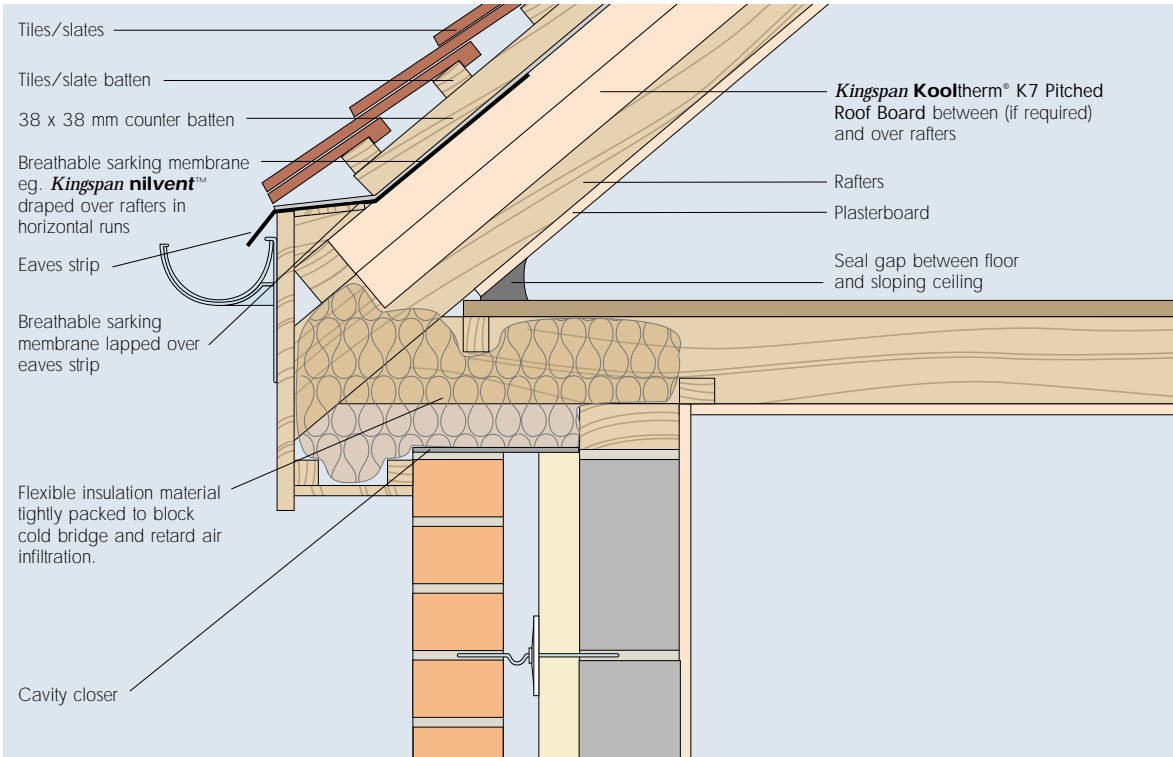
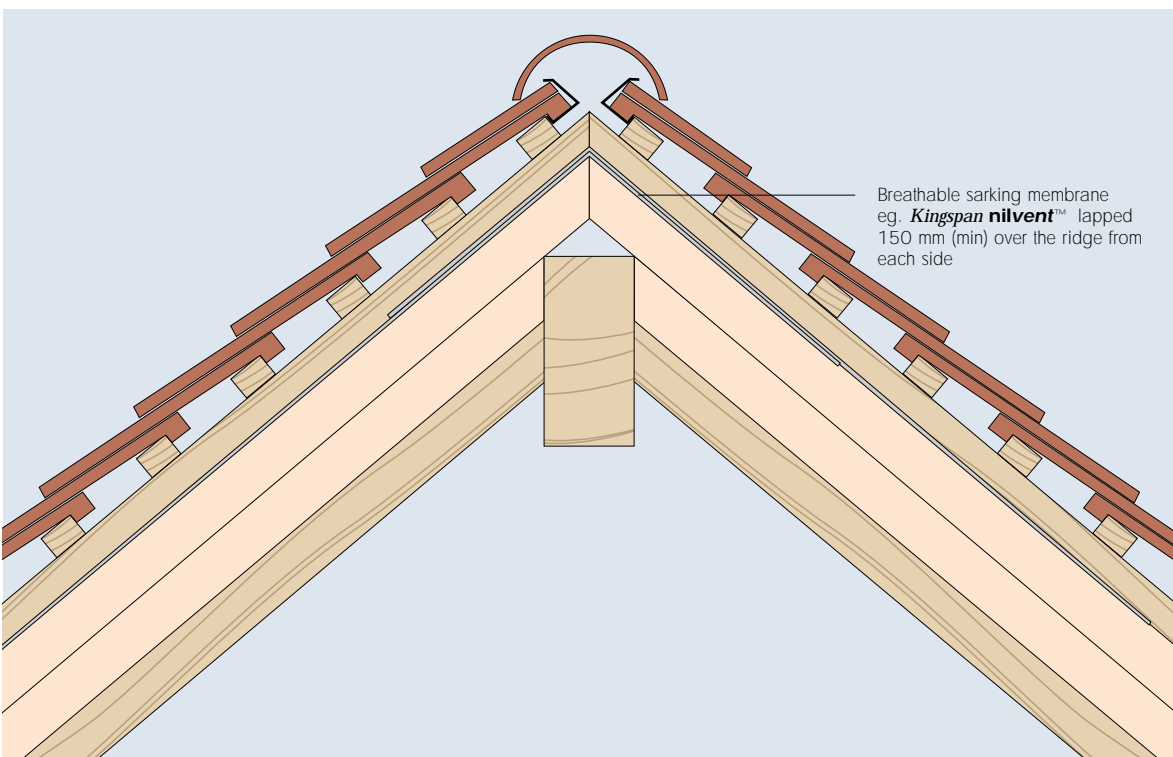
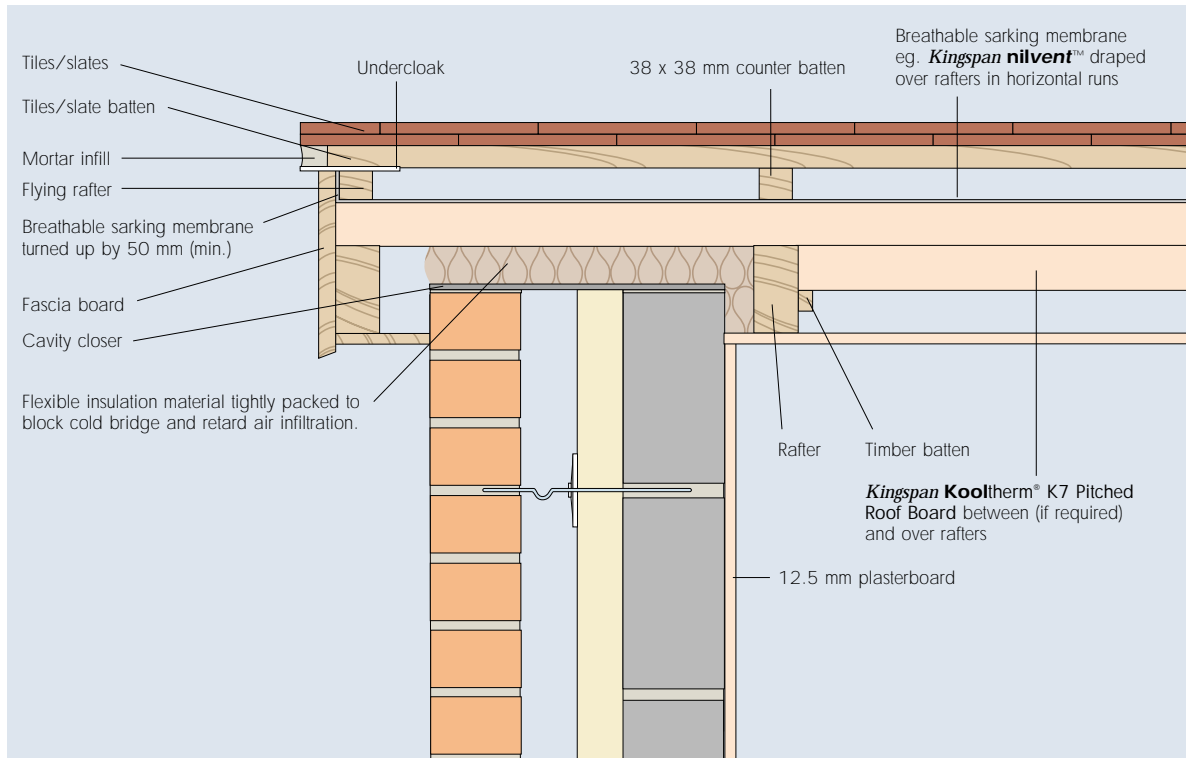


Figure 9b RIDGE DETAIL - SECTION PERPENDICULAR TO RIDGE



Kingspan **Kooltherm**® K7 Pitched Roof Board

Figure 9c SECTION PARALLEL TO RIDGE



DAILY WORKING PRACTICE

Installed **Kingspan Kooltherm**® K7 Pitched Roof Boards should be protected against inclement weather.

FIXINGS FOR OVER RAFTER INSULATION

Helifix In-Skew, Target Skewfast, Wallfast Timfix or similar approved fixings should be applied at centres appropriate to the design of the roof and location of the building.

Refer to:

Helifix Limited +44 (0)20 8735 5222;
Target Fixings Limited +44 (0)1344 777 189; or
Wallfast Limited +44 (0)23 9265 3330.

AVAILABILITY

Kingspan Kooltherm® K7 Pitched Roof Board is available through specialist insulation distributors and selected builders and roofing merchants throughout the UK, Ireland and Europe.

PACKAGING

According to quantity, the boards are supplied in packs or on pallets, labelled and shrinkwrapped in polythene.

STORAGE

The packaging of **Kingspan Kooltherm**® K7 Pitched Roof Board should not be considered adequate for long term outside protection. Ideally boards should be stored inside a building. If however, outside storage cannot be avoided the boards should be stacked clear of the ground and covered with a polythene sheet or weatherproof tarpaulin. Boards that have been allowed to get wet should not be used.

HEALTH AND SAFETY

Kingspan Insulation products are chemically inert and safe to use. A leaflet on this topic which satisfies the requirements set out in the Control of Substances Hazardous to Health Regulations 1988 (COSHH) is available from our Technical Services Department (see rear cover).

Please note that the reflective surface on this product is designed to enhance its thermal performance. As such, it will reflect light as well as heat, including ultraviolet light. Therefore, if this board is being installed during very bright or sunny weather, it is advisable to wear UV protective sunglasses or goggles, and if the skin is exposed for a significant period of time, to protect the bare skin with a UV block sun cream.

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

PRODUCT DESCRIPTION

THE FACINGS

Kingspan Kooltherm® K7 Pitched Roof Board is faced on both sides with a low emissivity composite foil facing which is highly resistant to the transmission of water vapour. This reflective, low emissivity surface effectively doubles the thermal resistance of the cavity in which the board is placed.

THE CORE

The core of **Kingspan Kooltherm® K7 Pitched Roof Board** is a high performance CFC-free rigid phenolic insulant of typical density 45kg/m³.

CFC-FREE*

Kingspan Kooltherm® K7 Pitched Roof Board is produced using alternative blowing agents in compliance with the Montreal Protocol.

***Kingspan Kooltherm® K7 Pitched Roof Board** is also available CFC/HFC-free subject to enquiry.

PRODUCT DATA

STANDARDS AND APPROVALS

Kingspan Kooltherm® K7 Pitched Roof Board is manufactured to the highest standards under a quality control system approved to BS EN ISO 9002: 1994 (Quality systems. Model for quality assurance in production, installation and servicing). Its use is covered by BBA Certificate 94/3061.



STANDARD DIMENSIONS

Kingspan Kooltherm® K7 Pitched Roof Board is available in the following standard sizes and thicknesses:

Nominal Dimension	Availability
Length (m)	2.4
Width (m)	1.2*
Insulant Thickness** (mm)	20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70

* 1.16 m for insulant thicknesses over 50 mm.

** Other thicknesses are available subject to quantity.

INSULATION COMPRESSIVE STRENGTH

Typically exceeds 125 kPa at 10% compression when tested to BS 4370: Part 1: 1988 (1996) (Methods of test for rigid cellular materials).

WATER VAPOUR RESISTANCE

Modified to include board facings, the boards achieve a resistance far greater than 100 MN.s/g when tested in accordance with BS 4370: Part 2: 1993.

DURABILITY

If correctly applied, **Kingspan Kooltherm® K7 Pitched Roof Board** has an indefinite life. Its durability depends on the supporting structure and the conditions of its use.

RESISTANCE TO SOLVENTS, FUNGI & RODENTS

The insulation core is resistant to dilute acids, alkalis, mineral oil and petrol. It is not resistant to some solvent-based adhesive systems, particularly those containing methyl ethyl ketone. Adhesives containing such solvents should not be used in association with **Kingspan Kooltherm® K7 Pitched Roof Board**. Boards which have been in contact with harsh solvents, petrol, mineral oil or acids, or boards that have been damaged in any way should not be used.

The insulation core and facings used in the manufacture **Kingspan Kooltherm® K7 Pitched Roof Board** resist attack by mould and microbial growth and do not provide any food value to vermin.

FIRE PERFORMANCE

The rigid phenolic insulation core of **Kingspan Kooltherm® K7 Pitched Roof Board** will achieve the results given below which enables it to be classified by the Building Regulations as being Class O rated.

Kingspan Kooltherm® K7 Pitched Roof Board, when subjected to British Standard fire tests, achieves the results given below. Further details of the fire performance of Kingspan Insulation products may be obtained from our Technical Services Department (see rear cover).

Test	Result
BS 476: Part 3: 1975 (External fire exposure roof test)	SAA rating
BS 476: Part 6: 1989 (Fire Propagation Test)	Index of performance (I) (Fire not exceeding 12 and sub-index (i1) not exceeding 6 (for rigid phenolic insulation core)
BS 476: Part 7: 1997 (Surface Spread of Flame Test)	Class 1 rating for rigid phenolic insulation core
BS 5111: Part 1: 1974	< 5% (Smoke Obscuration)

CUSTOMER SERVICE

For quotations, order placement and details of despatches please contact our Building Fabric Insulation Customer Services Department on the numbers below:

UK – Telephone: +44 (0) 870 850 8555
– Fax: +44 (0) 870 850 8666
– email: commercial.uk@insulation.kingspan.com
Ireland – Telephone: +353 (0) 42 97 95000
– Fax: +353 (0) 42 97 46129
– email: commercial.ie@insulation.kingspan.com

TECHNICAL ADVICE

Kingspan Insulation Ltd support all of their products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a free computer-aided service designed to give fast, accurate technical advice. Simply phone our **TECHLINE** with your project specification and we can run calculations to provide U-values, condensation/dew point risk, required insulation thicknesses etc... Thereafter we can run any number of permutations to help you achieve your desired targets.

We can also give general application advice and advice on design detailing and fixing etc... Site surveys are also undertaken as appropriate.

Please contact our Building Fabric Insulation Technical Services Department on the **TECHLINE** numbers below:



UK: – Telephone: +44 (0) 870 850 8555
– Fax: +44 (0) 1544 387 278
– email: techline.uk@insulation.kingspan.com
Ireland: – Telephone: +353 (0) 42 97 95032
– Fax: +353 (0) 42 97 46129
– email: techline.ie@insulation.kingspan.com

LITERATURE AND SAMPLES

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

Available as a complete Design Manual, on CD-ROM or as individual product brochures, Kingspan Insulation technical literature is an essential specification tool. For copies please contact our Marketing Department on the numbers below:

UK – Telephone: +44 (0) 1544 387 210
– Fax: +44 (0) 1544 387 299
– email: literature.uk@insulation.kingspan.com
Ireland – Telephone: +353 (0) 42 97 95038
– Fax: +353 (0) 42 97 46129
– email: literature.ie@insulation.kingspan.com

GENERAL ENQUIRIES

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

UK – Telephone: +44 (0) 870 850 8555
– Fax: +44 (0) 870 850 8666
– email: info.uk@insulation.kingspan.com
Ireland – Telephone: +353 (0) 42 97 95000
– Fax: +353 (0) 42 97 46129
– email: info.ie@insulation.kingspan.com

Kingspan Insulation reserve the right to amend product specifications without prior notice. The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to uses described. Recommendations for use should be verified as to the suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation offers a free Technical Advisory Service (see left) whose advice should be sought for uses of Kingspan Insulation products that are not specifically described herein. Please check that your copy of the literature is current by contacting our Marketing Department (see above).



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