

# Flat Roof Drainage

ROOFING BEST PRACTICE FOR THE 21ST CENTURY



*Low Energy -  
Low Carbon Buildings*

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## Summary

*Kingspan ThermaTaper*<sup>®</sup> Systems comprise tapered insulation boards designed for warm deck flat roofing applications. Using these products to achieve a U-value of 0.16 W/m<sup>2</sup>·K could be up to 26.9% cheaper than using alternative methods to create a fall in a flat roof for drainage purposes.

*Kingspan ThermaTaper*<sup>®</sup> Systems do not need time to dry out saving time in the scheduling of a construction project. It is estimated that the screed to falls systems, used for the case studies in this document, may require between 122 and 195 days to dry.

*Kingspan ThermaTaper*<sup>®</sup> Systems can be as little as 1.5% of the weight of a solution using screed to falls with a flat insulation board.

## Current Practice

The provision of a fall in a warm deck flat roof is normally achieved in one of three ways: falls achieved by screed laid to falls; falls achieved by the use of tapered insulation; or falls achieved by the use of timber firrings under a plywood deck.

## Assessing the Alternatives for Future Practice

The purpose of this report is to examine these alternatives by means of three case studies.

The case studies are for new build non-residential projects with warm deck roofs only. Refurbishment is not covered.

The designs are based on achieving a U-value of 0.16 W/m<sup>2</sup>·K as an average across the whole roof, U-values are calculated in accordance with Annex C of BS EN ISO 6946: 2007.

Three case studies have been examined for this report, of varying sizes and plan complexity:

**Case Study 1:** A relatively small rectangular roof plan with simple falls.

**Case Study 2:** A slightly larger complex roof plan with more complicated falls.

**Case Study 3:** A much larger roof plan, with relatively simple falls.

Three design options have been costed for each case study: falls achieved by screed laid to falls; falls achieved by the use of tapered insulation, specifically *Kingspan ThermaTaper*<sup>®</sup> Systems, and falls achieved by the use of timber firrings under a plywood deck (more usually associated with timber or metal deck roofs).

The three case studies all employ a concrete sub-base but the conclusions regarding *Kingspan ThermaTaper*<sup>®</sup> Systems compared with timber firrings would be equally valid in a metal deck roof situation. (It is unlikely that a screed would be used with a metal deck roof).



RSPB Environment and Education Centre, Rainham Marshes: *Kingspan ThermaTaper*<sup>®</sup> TT47 LPC/FM

## Cost Analysis of the Alternatives

Kingspan Insulation commissioned independent quantity surveyor Davis Langdon to carry out a cost analysis of the three case studies detailed on page 3\*.

Cost per Square Metre of Roof Build-Up Above the Deck		
Case Study	Alternative	£/m <sup>2</sup>
1	Tapered insulation	98.23
1	Screed laid to falls	106.43
1	Timber firrings	127.19
2	Tapered insulation	107.42
2	Screed laid to falls	119.83
2	Timber firrings	140.83
3	Tapered insulation	96.91
3	Screed laid to falls	108.27
3	Timber firrings	132.53

In all three case studies the *Kingspan ThermaTaper*<sup>®</sup> System solution has been shown to be the cheapest option.

In these case studies, a screeded option has been shown to be £8 - 12 per m<sup>2</sup> more expensive than a *Kingspan ThermaTaper*<sup>®</sup> System solution.

In all three case studies the most expensive means of achieving drainage falls is by the use of timber firrings. Timber firrings are likely to be a more valid solution on a timber or metal deck roof structure than a concrete sub-base but, in the roof plans indicated by these case studies, are still likely to be a more expensive option than the use of *Kingspan ThermaTaper*<sup>®</sup> Systems.

\*A copy of the Davis Langdon & Everest report is available upon request from the Kingspan Insulation Marketing Department on 01544 387 384.

All rates based on UK average first quarter 2008 prices.



Jubilee Library, Brighton: *Kingspan ThermaTaper*<sup>®</sup> TT40

## Additional Benefits of Tapered Insulation

*Kingspan ThermaTaper*<sup>®</sup> Systems do not suffer from the two inherent disadvantages in the use of screeds, drying time and weight.

A standard cement:sand screed dries out in approximately one month per 25 mm thickness and weighs approximately 2000 kg/m<sup>3</sup>. NB the weight of wet screed would be marginally greater.

Drying Times and Weights for Alternatives in Each Case Study			
Case Study	Alternative	Approx. Drying Time (days)	Approx. Weight of Dry Screed (If Used) & Insulation (kg)
1	Tapered insulation	0	983
1	Screed laid to falls	128	41,242
2	Tapered insulation	0	1,676
2	Screed laid to falls	122	69,168
3	Tapered insulation	0	15,242
3	Screed laid to falls	195	998,110

Drying time could be improved by the use of a proprietary quick-drying screed.

A standard quick-drying screed dries out in approximately 7 days per 25 mm thickness. However the cost of such screeds is 40-50% higher than that of a normal cement:sand screed, ensuring the economic advantage of *Kingspan ThermaTaper*<sup>®</sup> Systems. Furthermore, a significant drying out period would still be required for thick screeds. Still faster drying out screeds are available but at a further cost penalty.

The weight of a screed can be of great consequence, as demonstrated by Case Study 3, where the average thickness is 160 mm. The weight of this would have undoubted consequences on the design of both the frame and foundations. This would inevitably incur an additional cost, adding to the economic advantage of *Kingspan ThermaTaper*<sup>®</sup> Systems. This cost has not been taken into account in the cost analysis presented in this document.

The use of a lightweight screed instead of a normal cement:sand screed would provide a partial benefit but these can cost up to double the cost of an ordinary cement:sand screed, establishing a significant margin between the screed and *Kingspan ThermaTaper*<sup>®</sup> System options (in favour of the *Kingspan ThermaTaper*<sup>®</sup> Systems).

## *Kingspan* **Thermataper**<sup>®</sup> Systems

- Provide insulation and drainage in one system.
- Include pre-mitred hips and valleys as standard.
- Can solve the problems associated with water ponding.
- Are compatible with all weatherproofing systems.
- Comprise high performance insulation, and can easily achieve required U-values.
- Provide a practical alternative to screeding, structural falls or firrings.
- Have negligible load bearing implications for new or existing structures.
- Are resistant to the passage of water vapour.
- Offer a high-tech solution that is easy to handle and install.
- Are ideal for newbuild and refurbishment.
- Are manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP).



Altolusso, Cardiff: *Kingspan* **Thermataper**<sup>®</sup> TT47 LPC/FM

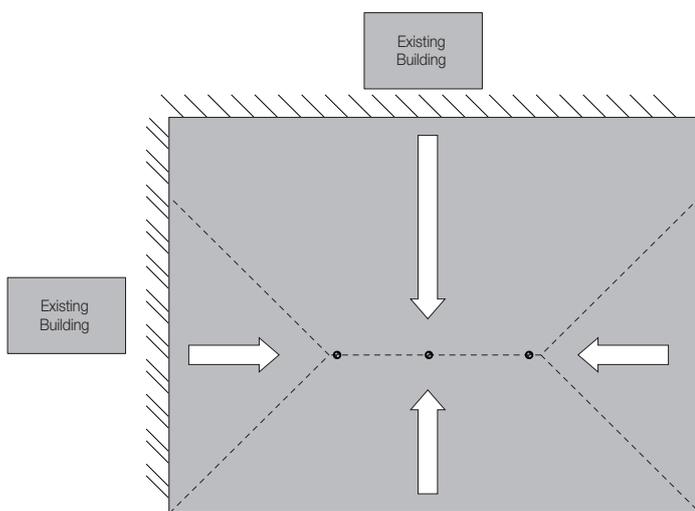


Cobblers Lane Primary School, Pontefract, West Yorkshire: *Kingspan* **Thermataper**<sup>®</sup> TT46 LPC/FM

# Case Study 1

## Single Storey Extension to Hospital Department

**Roof area:** 192 m<sup>2</sup>.  
**Roof shape:** simple plan.  
**Base structure:** 200 mm pre-cast concrete plank.  
**Waterproofing:** single ply polymeric roofing.  
**Drainage principles:** inward sloping to central roof outlets.  
**Fall:** 1 in 60.  
**U-value requirement:** 0.16 W/m<sup>2</sup>·K.  
**Soffit treatment:** mineral fibre suspended ceiling.



### Tapered Insulation with Pre-Mitred Hips and Valleys

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
Precast concrete roof slab	1.400	0.143
Airspace		0.000
Mineral fibre suspended ceiling		0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.312
Resistance of 160 mm average <i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM		5.926
Total resistance including insulation		6.238
U-value achieved (W/m <sup>2</sup> ·K)		0.16

Approximate weight of *Kingspan Thermataper*<sup>®</sup> TT47 LPC/FM Scheme (kg) (thickness x density [32 kg/m<sup>3</sup>] x roof area) 983

Approximate drying time of *Kingspan Thermataper*<sup>®</sup> TT47 LPC/FM Scheme (days) 0.0

Cost of option from deck upwards	£/m <sup>2</sup>
Bituminous primer to concrete deck	1.50
Bituminous vapour check fully bonded 160 mm average	4.25
<i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM	42.48
1.5 mm single ply membrane fully adhered	50.00
Cost of roof finish (above deck level)	98.23

Build up of cost of 160 mm average <i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM	£/m <sup>2</sup>
Supply only cost (£5060/roof area)	19.06
Disposal of waste material	0.04
Bitumen bonding (bonding area 343 m <sup>2</sup> x 1.00 £/m <sup>2</sup> / roof area)	1.79
Labour in laying	4.00
Sub-total	32.19
Sundries, profit and overheads (20%)	6.44
Main contractor's discount, profit and attendances (10%)	3.86
Rate per m <sup>2</sup>	42.48

### Screed Laid To Falls

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
105 mm average cement:sand screed	1.400	0.075
Precast concrete roof slab	1.400	0.143
Airspace		0.000
Mineral fibre suspended ceiling		0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.387
Resistance of 90 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.462
Resistance of 60 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		2.222
Total resistance including insulation		6.071
U-value achieved (W/m <sup>2</sup> ·K)		0.16
Approximate weight of dry screed and insulation (kg) {insulation thickness x density [32 kg/m <sup>3</sup> ] x roof area} + {screed thickness x density [2000 kg/m <sup>3</sup> ] x roof area}		41,242
Approximate drying time of screed (days)		128
<b>Cost of option from deck upwards</b>		<b>£/m<sup>2</sup></b>
105 mm average cement:sand (1:3) screed, laid to falls		22.00
Bituminous primer to screed		1.50
Bituminous vapour check fully bonded		4.25
150 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		28.68
1.5 mm single ply membrane fully adhered		50.00
Cost of roof finish (above deck level)		106.43
<b>Build up of cost of 150 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		<b>£/m<sup>2</sup></b>
Supply only cost		15.38
Waste (5%)		0.77
Disposal of waste material		0.08
Bitumen bonding		2.00
Labour in laying		3.50
Sub-total		21.72
Sundries, profit and overheads (20%)		4.34
Main contractor's discount, profit and attendances (10%)		2.61
Rate per m <sup>2</sup>		28.68

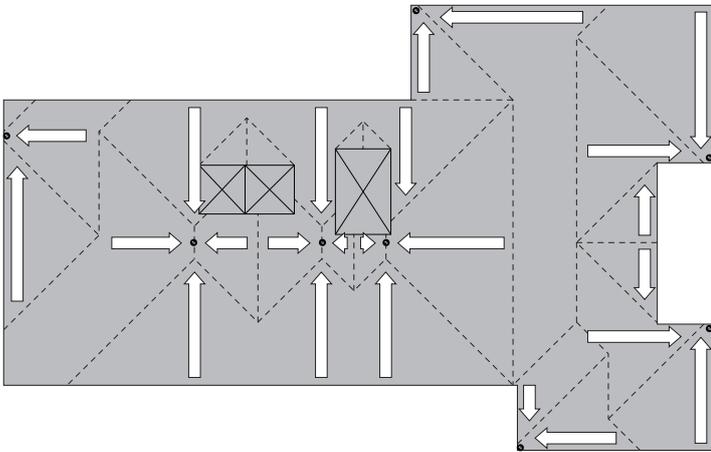
### Timber Firrings To Falls

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
18 mm plywood	0.140	0.129
Softwood firrings (incl. airspace)		0.163
Precast concrete roof slab	1.400	0.143
Airspace		0.000
Mineral fibre suspended ceiling		0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.604
Resistance of 95 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.654
Resistance of 50 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		1.852
Total resistance including insulation		6.110
U-value achieved (W/m <sup>2</sup> ·K)		0.16
<b>Cost of option from deck upwards</b>		<b>£/m<sup>2</sup></b>
Softwood joists/firrings fixed to concrete deck		23.00
18 mm WBP Plywood roof decking		22.00
Bituminous vapour check fully bonded		4.25
145 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM in two layers		27.94
1.5 mm single ply membrane fully adhered		50.00
Cost of roof finish (above deck level)		127.19
<b>Build up of cost of 145 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		<b>£/m<sup>2</sup></b>
Supply only cost		14.85
Waste (5%)		0.74
Disposal of waste material		0.07
Bitumen bonding		2.00
Labour in laying		3.50
Sub-total		21.72
Sundries, profit and overheads (20%)		4.23
Main contractor's discount, profit and attendances (10%)		2.54
Rate per m <sup>2</sup>		27.94

# Case Study 2

## Rebuilt Inner City Office Block

**Roof area:** 338 m<sup>2</sup>.  
**Roof shape:** more complicated plan.  
**Base structure:** 150 mm concrete slab on permanent metal deck formwork.  
**Waterproofing:** single ply polymeric roofing.  
**Drainage principles:** inward sloping to central roof outlets and outward sloping to perimeter roof outlets.  
**Fall:** 1 in 80.  
**U-value requirement:** 0.16 W/m<sup>2</sup>·K.  
**Soffit treatment:** plasterboard suspended ceiling.



### Tapered Insulation with Pre-Mitred Hips and Valleys

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
150 mm concrete slab	1.400	0.107
Permanent metal deck		0.000
Airspace		0.160
Plasterboard suspended ceiling	0.190	0.066
Internal surface resistance		0.100
Total resistance excluding insulation		0.502
Resistance of 155 mm average <i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM		5.741
Total resistance including insulation		6.243
U-value achieved (W/m <sup>2</sup> ·K)		0.16

Approximate weight of *Kingspan Thermataper*<sup>®</sup> TT47 LPC/FM Scheme (kg) (thickness x density [32 kg/m<sup>3</sup>] x roof area) 1,676

Approximate drying time of *Kingspan Thermataper*<sup>®</sup> TT47 LPC/FM Scheme (days) 0.0

Cost of option from deck upwards	£/m <sup>2</sup>
Smooth finish to concrete slab	3.00
Bituminous primer to concrete deck	1.50
Bituminous vapour check fully bonded	4.00
155 mm average <i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM	41.92
1.5 mm single ply membrane fully adhered	60.00
Cost of roof finish (above deck level)	107.42

Build up of cost of 155 mm average <i>Kingspan Thermataper</i> <sup>®</sup> TT47 LPC/FM	£/m <sup>2</sup>
Supply only cost (£8670/roof area)	25.65
Disposal of waste material	0.11
Bitumen bonding (bonding area 592 m <sup>2</sup> x 1.00 £/m <sup>2</sup> / roof area)	1.75
Labour in laying	4.25
Sub-total	31.76
Sundries, profit and overheads (20%)	6.35
Main contractor's discount, profit and attendances (10%)	3.81
Rate per m <sup>2</sup>	41.92

### Screed Laid To Falls

	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
<b>Roof layer</b>		
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
100 mm average cement:sand screed	1.400	0.071
150 mm concrete slab	1.400	0.107
Permanent metal deck		0.000
Airspace		0.163
Plasterboard suspended ceiling	0.190	0.066
Internal surface resistance		0.100
Total resistance excluding insulation		0.576
Resistance of 95 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.654
Resistance of 50 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		1.852
Total resistance including insulation		6.082
U-value achieved (W/m <sup>2</sup> ·K)		0.16
Approximate weight of dry screed and insulation (kg) {insulation thickness x density [32 kg/m <sup>3</sup> ] x roof area} + {screed thickness x density [2000 kg/m <sup>3</sup> ] x roof area}		
		69,168
Approximate drying time of screed (days)		
		122
<b>Cost of option from deck upwards</b>		
		£/m <sup>2</sup>
100 mm average cement:sand (1:3) screed, laid to falls		24.00
Bituminous primer to screed		1.50
Bituminous vapour check fully bonded		4.00
145 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM in two layers		30.33
1.5 mm single ply membrane fully adhered		60.00
Cost of roof finish (above deck level)		119.83
<b>Build up of cost of 145 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		
		£/m <sup>2</sup>
Supply only cost		14.85
Waste (5%)		1.49
Disposal of waste material		0.15
Bitumen bonding		2.00
Labour in laying		4.50
Sub-total		22.98
Sundries, profit and overheads (20%)		4.60
Main contractor's discount, profit and attendances (10%)		2.76
Rate per m <sup>2</sup>		30.33

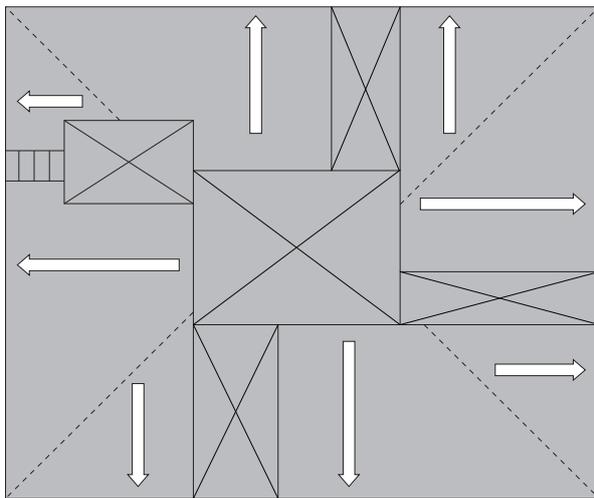
### Timber Firrings To Falls

	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
<b>Roof layer</b>		
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
18 mm plywood	0.140	0.129
Softwood firrings (incl. airspace)		0.163
150 mm concrete slab	1.400	0.107
Permanent metal deck		0.000
Airspace		0.163
Plasterboard suspended ceiling	0.190	0.066
Internal surface resistance		0.100
Total resistance excluding insulation		0.797
Resistance of 80 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.077
Resistance of 60 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		2.222
Total resistance including insulation		6.096
U-value achieved (W/m <sup>2</sup> ·K)		0.25
<b>Cost of option from deck upwards</b>		
		£/m <sup>2</sup>
Softwood joists/firrings fixed to concrete deck		25.00
18 mm WBP Plywood roof decking		22.50
Bituminous vapour check fully bonded		4.00
140 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM in two layers		29.33
1.5 mm single ply membrane fully adhered		60.00
Cost of roof finish (above deck level)		140.83
<b>Build up of cost of 140 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		
		£/m <sup>2</sup>
Supply only cost		14.16
Waste (5%)		1.42
Disposal of waste material		0.14
Bitumen bonding		2.00
Labour in laying		4.50
Sub-total		22.22
Sundries, profit and overheads (20%)		4.44
Main contractor's discount, profit and attendances (10%)		2.67
Rate per m <sup>2</sup>		29.33

# Case Study 3

## New Build Open Aspect Office Building with Central Atrium and Roof Level Plant Rooms

Roof area:	3073 m <sup>2</sup> .
Roof shape:	simple plan - lower roof level excluding atrium and plant room roofs.
Base structure:	300 mm in-situ concrete deck.
Waterproofing:	single ply polymeric roofing.
Drainage principles:	outward sloping to perimeter gutter.
Fall:	1 in 80.
U-value requirement:	0.16 W/m <sup>2</sup> ·K.
Soffit treatment:	mineral fibre suspended ceiling.



### Tapered Insulation with Pre-Mitred Hips and Valleys

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
300 mm concrete slab	1.400	0.214
Airspace		0.000
Mineral wool suspended ceiling	0.055	0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.383
Resistance of 155 mm average Kingspan <b>Thermataper</b> <sup>®</sup> TT47 LPC/FM		5.741
Total resistance including insulation		6.124
U-value achieved (W/m <sup>2</sup> ·K)		0.16
Approximate weight of Kingspan <b>Thermataper</b> <sup>®</sup> TT47 LPC/FM Scheme (kg) (thickness x density [32 kg/m <sup>3</sup> ] x roof area)		15,242
Approximate drying time of Kingspan <b>Thermataper</b> <sup>®</sup> TT47 LPC/FM Scheme (days)		0.0
<b>Cost of option from deck upwards</b>		<b>£/m<sup>2</sup></b>
Smooth finish to concrete slab		3.00
Bituminous primer to concrete deck		1.50
Bituminous vapour check fully bonded		3.75
155 mm average Kingspan <b>Thermataper</b> <sup>®</sup> TT47 LPC/FM		46.66
1.5 mm single ply membrane fully adhered		45.00
Cost of roof finish (above deck level)		96.91
<b>Build up of cost of 155 mm average Kingspan <b>Thermataper</b><sup>®</sup> TT47 LPC/FM</b>		<b>£/m<sup>2</sup></b>
Supply only cost (£91260/roof area)		29.70
Disposal of waste material		0.03
Bitumen bonding (bonding area 6530 m <sup>2</sup> x 1.00 £/m <sup>2</sup> / roof area)		2.12
Labour in laying		3.50
Sub-total		35.35
Sundries, profit and overheads (20%)		7.07
Main contractor's discount, profit and attendances (10%)		4.24
Rate per m <sup>2</sup>		46.66

### Screed Laid To Falls

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
160 mm average cement:sand screed	1.400	0.114
300 mm concrete slab	1.400	0.214
Airspace		0.000
Mineral fibre suspended ceiling		0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.497
Resistance of 90 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.462
Resistance of 60 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		2.222
Total resistance including insulation		6.181
U-value achieved (W/m <sup>2</sup> ·K)		0.16
Approximate weight of dry screed and insulation (kg) {insulation thickness x density [32 kg/m <sup>3</sup> ] x roof area} + {screed thickness x density [2000 kg/m <sup>3</sup> ] x roof area}		998,110
Approximate drying time of screed (days)		195
<b>Cost of option from deck upwards</b>		<b>£/m<sup>2</sup></b>
160 mm average cement:sand (1:3) screed, laid to falls		30.00
Bituminous primer to screed		1.50
Bituminous vapour check fully bonded		3.75
150 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM in two layers		28.02
1.5 mm single ply membrane fully adhered		45.00
Cost of roof finish (above deck level)		108.27
<b>Build up of cost of 150 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		<b>£/m<sup>2</sup></b>
Supply only cost		15.38
Waste (5%)		0.77
Disposal of waste material		0.08
Bitumen bonding		2.00
Labour in laying		3.00
Sub-total		21.22
Sundries, profit and overheads (20%)		4.24
Main contractor's discount, profit and attendances (10%)		2.55
Rate per m <sup>2</sup>		28.02

### Timber Firrings To Falls

Roof layer	Thermal conductivity (W/m·K)	Thermal resistance (m <sup>2</sup> ·K/W)
External surface resistance		0.040
1.5 mm single ply membrane	0.160	0.009
Bituminous vapour check		0.020
18 mm plywood	0.140	0.129
Softwood firrings (incl. airspace)		0.163
300 mm concrete slab	1.400	0.214
Airspace		0.000
Mineral fibre suspended ceiling		0.000
Internal surface resistance		0.100
Total resistance excluding insulation		0.675
Resistance of 95 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		3.654
Resistance of 50 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM		1.852
Total resistance including insulation		6.181
U-value achieved (W/m <sup>2</sup> ·K)		0.16
<b>Cost of option from deck upwards</b>		<b>£/m<sup>2</sup></b>
Softwood joists/firrings fixed to concrete deck		35.00
18 mm WBP Plywood roof decking		21.50
Bituminous vapour check fully bonded		3.75
145 mm <i>Kingspan Thermaroof</i> <sup>®</sup> TR27 LPC/FM in two layers		27.28
1.5 mm single ply membrane fully adhered		45.00
Cost of roof finish (above deck level)		132.53
<b>Build up of cost of 145 mm <i>Kingspan Thermaroof</i><sup>®</sup> TR27 LPC/FM in two layers</b>		<b>£/m<sup>2</sup></b>
Supply only cost		14.85
Waste (5%)		0.74
Disposal of waste material		0.07
Bitumen bonding		2.00
Labour in laying		3.00
Sub-total		20.67
Sundries, profit and overheads (20%)		4.13
Main contractor's discount, profit and attendances (10%)		2.48
Rate per m <sup>2</sup>		27.28

# Contact Details

## Customer Service

For quotations, order placement and details of despatches please contact the Kingspan Insulation Customer Service Department on the numbers below:

Tel: +44 (0) 1544 388 601  
Fax: +44 (0) 1544 388 888  
email: [customerservice.uk@insulation.kingspan.com](mailto:customerservice.uk@insulation.kingspan.com)

## Literature & Samples

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

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

Tel: +44 (0) 1544 387 384  
Fax: +44 (0) 1544 387 484  
email: [literature.uk@insulation.kingspan.com](mailto:literature.uk@insulation.kingspan.com)

## Tapered Roofing

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

Tel: +44 (0) 1544 387 383  
Fax: +44 (0) 1544 387 483  
email: [tapered.uk@insulation.kingspan.com](mailto:tapered.uk@insulation.kingspan.com)

## Technical Advice / Design

Kingspan Insulation supports all of its products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a computer-aided service designed to give fast, accurate technical advice. Simply phone the Kingspan Insulation Technical Service Department with your project specification. Calculations can be carried out to provide U-values, condensation / dew point risk, required insulation thicknesses etc... Thereafter any number of permutations can be provided to help you achieve your desired targets.

The Kingspan Insulation Technical Service Department can also give general application advice and advice on design detailing and fixing etc... Site surveys are also undertaken as appropriate.

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

Tel: +44 (0) 1544 387 382  
Fax: +44 (0) 1544 387 482  
email: [technical.uk@insulation.kingspan.com](mailto:technical.uk@insulation.kingspan.com)

## General Enquiries

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

Tel: +44 (0) 1544 388 601  
Fax: +44 (0) 1544 388 888  
email: [info.uk@insulation.kingspan.com](mailto:info.uk@insulation.kingspan.com)

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**Kingspan Insulation Ltd**  
Pembridge, Leominster, Herefordshire HR6 9LA, UK

[www.insulation.kingspan.co.uk](http://www.insulation.kingspan.co.uk)