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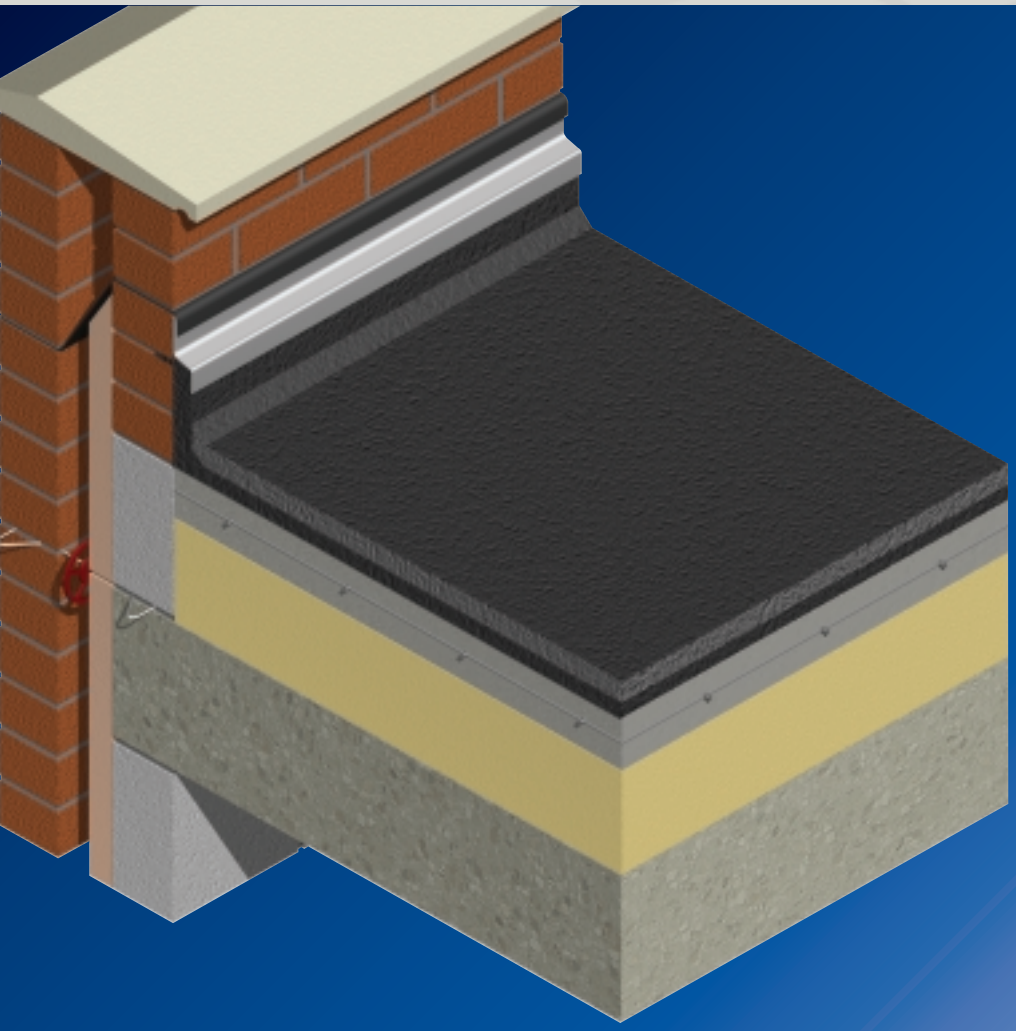
Fifth Issue November 2005

Styrozone® N 500 R/N 700 R

PROTECTED MEMBRANE HEAVY DUTY CAR PARK DECKS



- High performance rigid extruded polystyrene insulation – thermal conductivity 0.034–0.038 W/m·K
- Protects waterproofing membrane
- Closed cell structure minimises water absorption
- High compressive strength withstands vehicle loads
- Withstands freeze/thaw cycling
- Resistant to the passage of water vapour
- Easy to handle and install
- Ideal for newbuild and refurbishment
- Non–deleterious material
- CFC/HCFC–free with zero Ozone Depletion Potential (ODP)

zero o.d.p

Kingspan® Insulation Solutions

Styrozone® N 500 R/N 700 R

Typical Design Details

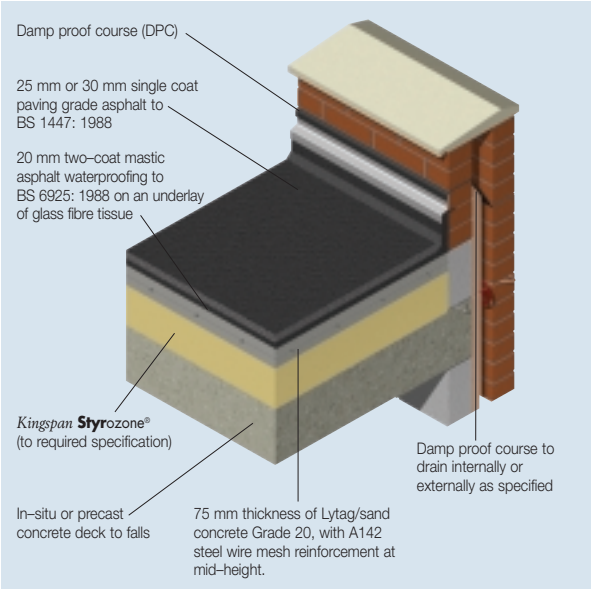


Figure 1 Concrete Slab Finish Parking Decks, Cars and Light Commercial Vehicles (Non HGV) (Maximum Individual Wheel Load – 1 Tonne)

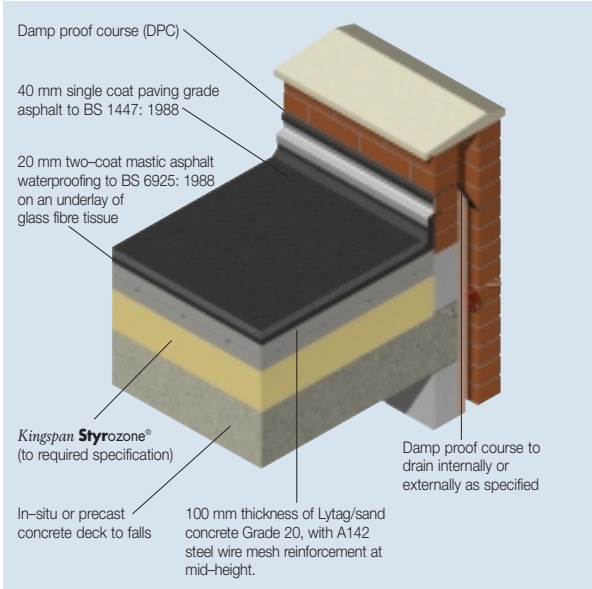


Figure 2 Concrete Slab Finish Loading Bays and Service Decks Commercial Vehicles (Design Should be Verified as to Suitability for Specific Wheel Loads)

Specification Clause

Kingspan **Styr**ozone® should be described in the specification as:–

The protected membrane roof insulation shall be *Kingspan* **Styr**ozone® N 500 R/N 700 R* comprising ____mm thick CFC/HCFC–free rigid extruded polystyrene insulation manufactured to BS EN ISO 9001: 2000 and shall be applied in accordance with the instructions issued by Kingspan Insulation Limited.

Details also available in NBS PLUS.
NBS users should refer to clause(s):
J21 440, J41 440
(Standard and Intermediate)

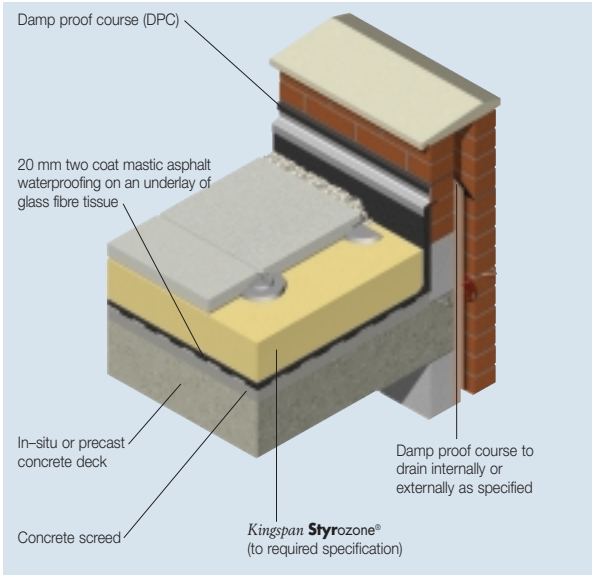


Figure 3 Paving Slab Finish

Design Considerations

General

This brochure shows the use of *Kingspan* **Styr**ozone® in a protected membrane roofing system for car park decks using both cast in–situ concrete slab (Figure 1 & 2) and paving slab (Figure 3) finishes.

Protected membrane roofing systems place the insulation above the waterproof system and offer several advantages over traditional warm flat roofs.

The waterproofing system can be expected to have a life in excess of that obtained in an exposed situation as it is protected from mechanical damage, solar radiation, ultra–violet degradation and temperature extremes (both daily and seasonal). Extruded polystyrene with its closed cell structure and minimal water absorption is the only material suitable and approved for this application where it will be subject to wetting/drying and freeze/thaw cycles.

Within the *Kingspan* **Styr**ozone® range two grades are available for car park deck applications – *Kingspan* **Styr**ozone® N 500 R and *Kingspan* **Styr**ozone® N 700 R (*Kingspan* **Styr**ozone® H 350 can also be used for applications where excessive loadings are unlikely to occur. Please contact the Kingspan Insulation Technical Services Department for further information). These grades encompass the properties required for specifications ranging from cars and light commercial vehicles to loading bays and service decks for heavy goods vehicles.

Insulation systems can be designed to maintain a protected membrane roofing system or to utilise a combined waterproof and traffic wearing asphalt.

Wearing Surface

Data on specific concentrated loads is contained in BS 6399–1: 1996 (Loading for buildings. Code of practice for dead and imposed loads). Department of Transport departmental standard BD 21/84 gives typical single wheel loads, depending on the type of vehicle, that act over a 150 mm square or 1760 mm diameter contact area. The tyre pressure is taken as 1.1 N/mm^2, in practice real tyre pressures are lower than this thus giving a lower load intensity.

Vehicle type (weight in tonnes)	Nominal single wheel load (kN)
Cars and vans (<3)	25
Vehicles generally (3–7.5)	50
Vehicles generally (7.5–40)	100
Fire engines (up to 60 kN axle load)	30
Fire engines (up to 120 kN axle load)	60

Roof Structure

Whilst almost any form or roof deck (timber, metal or concrete) can be used with protected membrane roofing systems, the traffic load and additional dead load from the ballast layer invariably limits this type of roof to concrete decks.

Typical U-values

The following examples have been calculated using the combined method for compliance with Building Regulations/Standards revised after the year 2002. These examples are based on the use of 150 mm concrete deck, 50 mm screed and mastic asphalt waterproofing with paving slab finish. The ceiling is taken to be 12.5 mm plasterboard with a cavity between it and the underside of the deck.

If your construction is any different or you need Hazardous to Health Regulations 1988 (COSHH) information, please contact the Kingspan Insulation Marketing Department.

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

NB when calculating U–values using the combined method as detailed in BS/I.S. 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 quoted are for guidance only. A detailed U–value calculation together with condensation risk analysis should be completed for each individual project. Please call the Kingspan Insulation Technical Services Department for assistance (see rear cover).

Styrozone® N 500 R/N 700 R

The table below is valid for the use of *Kingspan* **Styr**ozone® N 500 R as shown in Figure 3.

Dense Concrete Deck With suspended Plasterboard Ceiling and paving slab finish

Insulant Thickness (mm)	U–value (W/m²·K)
75	0.43
80	0.41
90	0.38
100	0.35
110	0.32
120	0.30
125	0.30
130	0.29
140	0.28
145	0.27
150	0.26
160	0.25
170	0.23
175	0.23
180	0.22
190	0.21
200	0.20

NB at greater thicknesses it may prove more cost effective to use a double layer system of thinner boards.

For U–values greater than 0.20 W/m²·K please contact the Kingspan Technical Department, see rear cover.

The table below is valid for the use of *Kingspan* **Styr**ozone® N 700 R as shown in Figure 3.

Dense Concrete Deck With suspended Plasterboard Ceiling and paving slab finish

Insulant Thickness (mm)	U–value (W/m²·K)
75	0.44
80	0.42
90	0.38
100	0.35
150	0.25
160	0.24
175	0.22
180	0.21
190	0.20
200	0.20

NB at greater thicknesses it may prove more cost effective to use a double layer system of thinner boards.

For U–values greater than 0.20 W/m²·K please contact the Kingspan Technical Department, see rear cover.

Sitework

General

Prior to installing the insulation it is essential to ensure that the waterproofing system has been installed correctly and that the roof is watertight and clean. Single–ply membranes in particular need careful attention to ensure that there has been no damage from following trades and that puncturing from below the membrane (from nail heads or debris) cannot occur. Existing roofs should be swept clean and any loose gravel chippings removed, if the chippings are bonded a foamed polyethylene cushion layer should be used prior to laying the insulation.

Filtration and cushioning membranes should be installed in accordance with recommendations above depending upon the insulation and ballast system used. The boards should be laid tightly butted and there must be no gaps where they meet upstands, rooflights etc. The boards are easily cut and shaped using a fine toothed saw, sharp knife or a rasp.

Start laying the boards from the point of access to the roof and as soon as possible apply the ballast layer. This ensures that the waterproof membrane is always protected and excessive heat build up or high winds do not damage boards. Ensure that ballast awaiting laying is not concentrated in one area where it may overload the roof structure.

Kingspan **Styr**ozone® insulation boards can be laid in any weather, but due to the light weight of the boards care must be taken in windy conditions.

Cast In–situ Concrete Slab

A 25 mm layer of washed, rounded gravel, nominal 6 mm diameter, is laid on a filtration membrane laid on the insulation boards. A building paper is then loose laid on to gravel this prevents mixing of the concrete and gravel during placing and compaction. The reinforcement can then be fixed and the concrete placed and compacted in accordance with BS 8110–1: 1997 (Structural use of concrete. Code of practice for design and construction).

Paving Slab Ballast

Paving slabs, minimum 50 mm thick, are laid on proprietary paving slab supports of minimum diameter 300 mm (or equivalent base area) in order to maintain drainage below the slabs and to ensure that moisture vapour can escape.

Site Protection
Where the roof deck is to be used by other trades as a working platform after the *Kingspan* **Styr**ozone® has been laid, the roof should be close–boarded to prevent any damage to the completed deck.

Site Practice
On completion the roof should be swept clean and all contractual equipment or debris removed.

Availability
Kingspan **Styr**ozone® is available through specialist insulation distributors and selected builders merchants throughout Britain and Ireland.

Packaging
The panels are supplied in labelled packs shrinkwrapped in polythene.

Storage
The packaging of *Kingspan* **Styr**ozone® should not be considered adequate for long term outside protection.

Kingspan **Styr**ozone® should be stored flat in a ventilated area and protected generally from accidental damage, contact with volatile solvents, flames and extended exposure to UV and sunlight. If it is stored outside for more than a few weeks, it must be covered with a pale pigmented plastic sheet.

Kingspan **Styr**ozone® should not be left in the sun covered by either a transparent or a dark plastic sheet, since in both cases, board temperatures can build up to a level hot enough to appreciably alter their dimensions or warp them.

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

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

Composition
Kingspan **Styr**ozone® N 500 R and N 700 R are high performance rigid extruded polystyrene insulants of typical density 40 and 45 kg/m³ respectively, with a smooth, dense skin on both faces.

CFC/HCFC–free
Kingspan **Styr**ozone® is manufactured without the use of CFCs/HCFCs and has zero Ozone Depletion Potential (ODP).

zero O.D.P

Product Data

Standards and Approvals
Kingspan **Styr**ozone® is manufactured to the highest quality standards under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Manufactured to BS EN ISO 9001: 2000

Standard Dimensions
Kingspan **Styr**ozone® N 500 R and N 700 R are available in the following standard sizes and thicknesses:

Nominal Dimension		Availability
Length	(m)	1.25
Width	(m)	0.6
Insulant Thickness	(mm)	Refer to local distributor or Kingspan Insulation price list for current stock and non-stock sizes.
Edge Profile		Rebated to all four edges

Insulation Compressive Strength
The compressive strengths of *Kingspan* **Styr**ozone® N 500 R and N 700 R typically exceed 500 and 700 kPa respectively at 10% compression when tested to BS EN 826: 1996 (Thermal insulating products for building applications. Determination of compression behaviour).

Thermal Expansion
The linear thermal expansion coefficient of *Kingspan* **Styr**ozone® is 0.07 mm W/m·K when tested to BS 4370–3: 1988 (2002) (Methods of test for rigid cellular materials. Methods 12 and 13).

Water Vapour Resistivity
The boards achieve a resistivity greater than 350 MNs/gm when tested in accordance with BS EN 12086: 1997 (Thermal insulating products for building applications. Determination of water vapour transmission properties).

Styrozone® N 500 R/N 700 R

Absorption of Moisture

Kingspan **Styr**ozone® is not sensitive to moisture of any kind. Its surface is water–repellent and there is no capillary suction. The material is also not hygroscopic. Over a 28 day cycle with temperature fluctuating 20/40°C its water absorption is < 0.7% when tested to BS EN 12087: 1997 (Thermal insulating products for building applications. Determination of long term water absorption by immersion).

Durability

If correctly applied, *Kingspan* **Styr**ozone® has an indefinite life. Its durability depends on the supporting structure, waterproofing and the conditions of its use.

Resistance to Solvents, Fungi & Rodents

Kingspan **Styr**ozone® is resistant to most dilute acids and alkalis. It may not be resistant to some solvent–based adhesive systems, particularly those containing methyl ethyl ketone. Adhesives containing such solvents should not be allowed to come into contact with *Kingspan* **Styr**ozone®. Edible oils, white oil, petroleum jelly and fuel oil should also be avoided. Organic solvents, petrol, petroleum solvents, and solvent based cold bitumen and or mastic will have a detrimental effect if allowed to come into contact with the boards. In the event of the boards coming onto contact with harsh solvents, petrol, mineral oil or acids or being damaged in any other way, they should not be used. If already fixed, they should be replaced.

Kingspan **Styr**ozone® resists attack by mould and microbial growth.

Kingspan **Styr**ozone® does not provide any food value to vermin and is not normally attractive to them.

Fire Performance

Flat roofs incorporating *Kingspan* **Styr**ozone® N 500 R or N 700 R protected membrane roof insulation and waterproofed using built–up felt or mastic asphalt, when subjected to British Standard fire tests, achieves the results given below. Further details on the fire performance of rigid extruded polystyrene can be obtained from the Kingspan Insulation Technical Services Department (see rear cover).

When tested in accordance with the requirements of DIN 4102 – B1 is obtained – not readily ignitable.

Test	Result
BS 476–3: 1958 (External fire exposure roof test)	FAA rating

Maximum Service Temperature

Kingspan **Styr**ozone® should not be brought into direct contact with high temperature heat sources. The maximum service temperature of *Kingspan* **Styr**ozone® is 75°C.

NB Styrozone will be delivered in packaging bearing the Uralita Batifoam or Poliglas Glascofoam names.

Thermal Properties

The λ-values and R-values quoted are in accordance with the Harmonised European Standard BS EN 13164: 2001 (Thermal insulation products for buildings - Factory made products of extruded polystyrene (XPS) – Specification) using so called 90/90 principles. Comparison with alternative products may not be appropriate unless the same procedures have been followed.

Thermal Conductivity

The thermal conductivity (λ–value) of *Kingspan* **Styr**ozone® N 500 R is 0.034 W/m·K (insulant thickness ≤ 60 mm), 0.036 W/m·K (insulant thickness 61–120 mm) and 0.038 W/m·K (insulant thickness > 120 mm).

The thermal conductivity (λ–value) of *Kingspan* **Styr**ozone® N 700 R is 0.036 W/m·K (insulant thickness 50–60 mm) and 0.037 W/m·K (insulant thickness 70–100 mm).

Thermal Resistances

Thermal resistance (R–value), varies with thickness and is calculated by dividing the thickness of the individual element (expressed in metres) by its thermal conductivity.

Additionally, an allowance of 20% of the calculated resistance is made to compensate for saturated roofs during long periods of rain in accordance with BS 5250: 2002 (Code of practice for control of condensation in buildings). The following table of design resistance values takes this allowance into account.

Insulant Thickness (mm)	Thermal Resistance (m^2·K/W)	
	N 500 R	N 700 R
75	2.05	2.00
80	2.20	2.15
90	2.50	2.40
100	2.75	2.70
110	3.05	
120	3.30	
125	3.25	
130	3.40	
140	3.65	
150	3.90	
160	4.20	
170	4.45	
175	4.60	
180	4.70	
190	5.00	
200	5.25	

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

Kingspan Insulation

Kingspan Insulation offers an extensive range of premium and high performance insulation products, breathable membranes and pre–fabricated/ pre–insulated systems for the construction industry. Following an extensive investment programme, Kingspan Insulation is continuing to lead the insulation industry by manufacturing its insulation products with zero Ozone Depletion Potential (ODP) and quoting thermal performance data in accordance with the new harmonised European Standards.

Kingspan Insulation Limited specialise in the solution of insulation problems. The Kingspan Insulation range of insulation products meet the exacting requirements of the construction industry are produced to the highest standards, including BS EN ISO 9001: 2000/I.S. EN ISO 9001: 2000. Each product has been designed to fulfil a specific need and has been manufactured to precise standards and tolerances.

Insulation for:

- Pitched Roofs
- Flat Roofs
- Cavity Walls
- Timber and Steel Framing
- Externally Insulated Cladding Systems
- Floors
- Soffits

Solutions:

- Insulated Dry Lining
- Tapered Roofing Systems
- *Kingspan* **Kool**Duct® Pre–Insulated Ducting
- *Kingspan* **nilvent**® Breathable Membranes

The Kingspan Insulation Product Range

The *Kingspan* Kooltherm® **K–range**

- With a thermal conductivity of 0.021–0.024 W/m·K CFC/HCFC–free rigid phenolic insulation is the most thermally efficient insulation product commonly available.
- Utilises the thinnest possible insulation board to achieve required U–values.
- Fire performance can be equivalent to mineral fibre.
- Achieves a Class O fire rating to the Building Regulations and Low Risk rating for the Technical Standards in Scotland.
- Achieves the best possible rating of < 5% smoke obscuration when tested to BS 5111: Part 1: 1974.
- CFC/HCFC–free with zero Ozone Depletion Potential (ODP).

The *Kingspan* **Therma Range**

- With a thermal conductivity of 0.022–0.028 W/m·K CFC/HCFC–free rigid urethane insulation is one of the most thermally efficient insulation products commonly available.
- Easily achieves required U–values with minimum board thickness.
- Achieves the required fire performance for the intended application.
- CFC/HCFC–free with zero Ozone Depletion Potential (ODP).

The *Kingspan* Styrozone® **& Purlcrete Ranges**

- Rigid extruded polystyrene insulation (XPS) has the highest compressive strength of any commonly available insulant.
- Ideal for specialist applications such as inverted roofing and heavy–duty flooring.
- Easily achieves required U–values with minimum board thickness.
- Achieves the required fire performance for the intended application.
- CFC/HCFC–free with zero Ozone Depletion Potential (ODP).

All Products

- Their closed cell structure resists both moisture and water vapour ingress – problems which can be associated with open cell materials such as mineral fibre and which can result in reduced thermal performance.
- Unaffected by air movement – problems that can be experienced with mineral fibre and which can reduce thermal performance.
- Safe and easy to install – non–fibrous
- Provide reliable long term thermal performance over the lifetime of the building.

Contact Details

Customer Service

For quotations, order placement and details of despatches please contact the Kingspan 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

Literature & Samples

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

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

UK – Telephone: +44 (0) 870 733 8333
– 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

Tapered Roofing

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

UK – Telephone: +44 (0) 870 761 7770
– Fax: +44 (0) 1544 387 289
– email: tapered.uk@insulation.kingspan.com

Ireland – Telephone: +353 (0) 42 97 95032
– Fax: +353 (0) 42 97 95669
– email: tapered.ie@insulation.kingspan.com

Technical Advice/Design

Kingspan Insulation Ltd support all of their 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 *TECHLINE* 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 Services 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 Building Fabric Insulation Technical Services Department on the *TECHLINE* numbers below:

UK – Telephone: +44 (0) 870 850 8333
– Fax: +44 (0) 1544 387 278
– email: techline.uk@insulation.kingspan.com

Ireland – Telephone: +353 (0) 42 97 95032
– Fax: +353 (0) 42 97 95669
– email: techline.ie@insulation.kingspan.com

General Enquiries

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

UK – Telephone: +44 (0) 870 850 8555
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– email: info.uk@insulation.kingspan.com

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– email: info.ie@insulation.kingspan.com

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