GUIDANCE NOTES ON VARIOUS FORMS OF TIMBER DECAY

The main contractor is to ensure that the condition of the existing building fabric is to be noted and reported to the engineer as it is uncovered during the course of the works. Guidance should be sought from Engineer with regard to any timber decay.

Timber decay is normally caused by either fungal attack and/or insect or beetle infestation. There are a wide variety of fungi that will attack timber in houses and to simplify matters these are generally classed as either dry rot or wet rot. There are also several species of beetle that will infest timber.

DRY ROT

Dry Rot is classed as a brown rot, as it feeds on the pale coloured cellulose in the timber. The loss of this cellulose causes the timer to darken in colour. Brown rot can also be identified by the characteristic cuboidal cracking of the timber following the loss of the cellulose. Dry rot thrives in damp humid conditions and tends to require less moisture than wet rot. The fungus produces hyphal threads, which grow to form a white mass called a mycelium. The fruiting bodies are rust red in colour when mature, and are edged with white or grey. Evidence of dry rot can often be identified by red spore dust settling on surfaces.

One characteristic of dry rot is its ability to travel through or over brick or other non-timber materials if these surfaces are sufficiently damp. However, it does not have the ability to cause timber in another location to become wet and can only attack other timber if it is sufficiently damp.

WET ROT

There are a variety of wet rot species and these can be classed as either brown or white rot. White rot usually attack the lignin in timber causing the timber to whiten, hence the name. The most common wet rots are the Cellar Fungus and Mine Fungus and it is important to correctly identify the species of rot in order to determine the most appropriate remedial works. Wet rot normally attack saturated timber which is in contact with damp masonry, or has been affected by direct damp penetration or spillage. They require similar damp humid conditions as dry rot, but are on the whole easier to eradicate than dry rot.

GUIDANCE NOTES ON VARIOUS FORMS OF TIMBER DECAY (CONTINUED)

INSECT INFESTATION

Insect infestation of timber occurs when wood-boring beetles lay their eggs on timber. If the conditions are right, the eggs then hatch into larvae, which burrow through the timber creating a series of tunnels. Depending on the beetle species, these larvae can remain within the timber for many years. The size of the emergence hole will help identify the type of infesting beetle, as will the nature of the bore dust deposited when the beetle eats its way through the timber surface.

The Common Furniture Beetle, or Woodworm as it is known in its larval stage, is the most common wood-boring beetle in Ireland. It will infest both soft and hardwoods but tends to prefer sapwood because of its high moisture content and ready availability of nutrients. It will usually only attack heartwood when the timber has been affected by dampness and fungal attack.

Rev.	Date	By	Details Of Revision

Architect: ANDREW COWAN ARCHITECTS

O'Reilly Design
Consulting Structural & Civil Engineers
45a Manor Road, West Ealing,
London,W13 0JA.
Tel: +44-2893-367554
Mobile +44-77979-693590
E-mail: topni@sky.com
www.oreillydesign.co.uk

Ireland Office: 12 Old Shore Road, Carrickfergus,N.Ireland ,BT388TL

Project
RESIDENTIAL-REFURBISHMENT
4-CHALCOT-CRESCENT
PRIMROSE-HILL-LONDON-NW1.

Title
SPECIFICATION-DETAILS
SHEET-1

Drawing No.	ORD/286/SK01
Drawn	SO'R
Date	FEB'17
Scale:	N.T.S
Chk.	

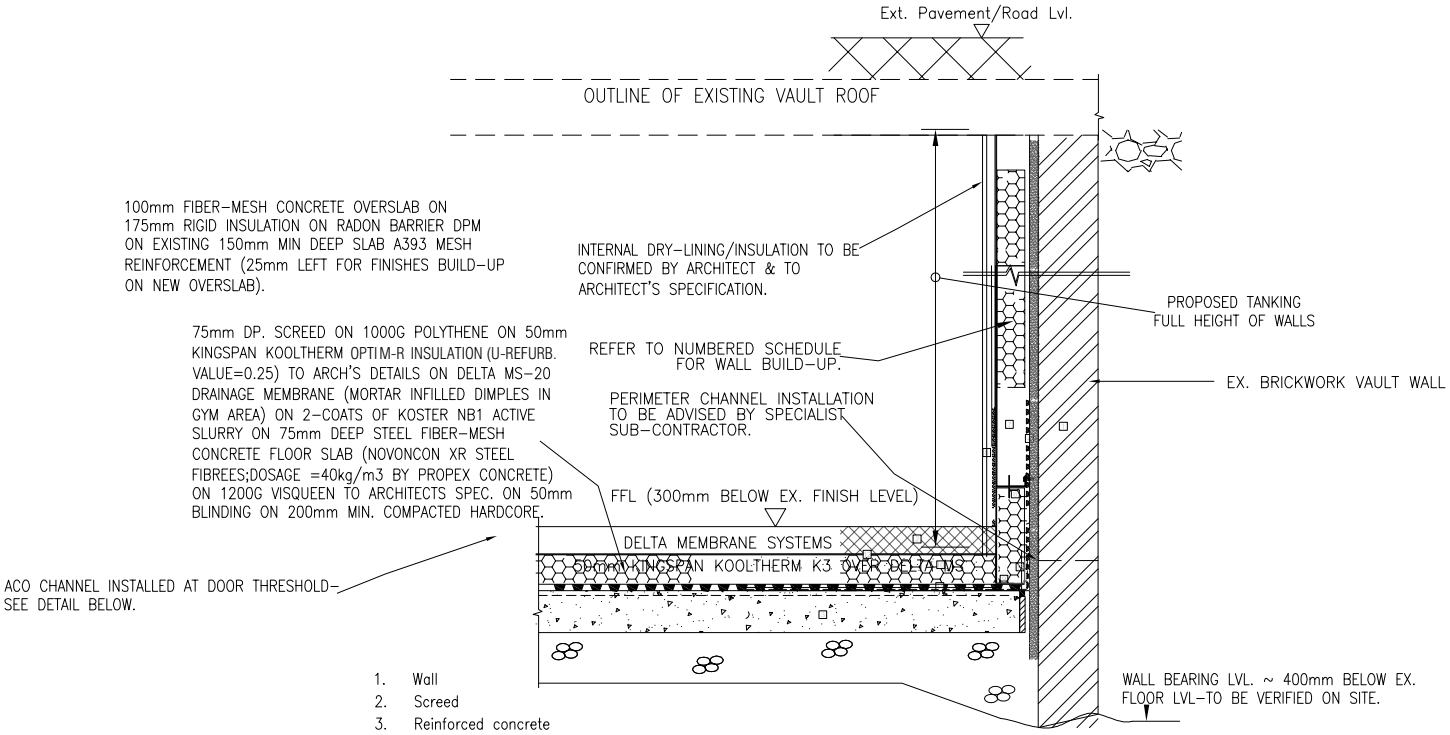
Architect: ANDREW COWAN ARCHITECTS
O'Reilly Design
Consulting Structural & Civil Engineers
45a Manor Road, West Ealing,
London,W13 0JA.
Tel: +44-2893-367554
Mobile +44-77979-693590
E-mail: topni@sky.com
www.oreillydesign.co.uk
Ireland Office: 12 Old Shore Road, Carrickfergus,N.Ireland ,BT388TL

Project
RESIDENTIAL-REFURBISHMENT
4-CHALCOT-CRESCENT
PRIMROSE-HILL-LONDON-NW1.

Drawing No. ORD/286/SK03
Drawn SO'R
Date FEB'17
Scale: N.T.S
Chk.

Title
BASEMENT-FLOOR-REMEDIAL-DETAILS
SHEET-2

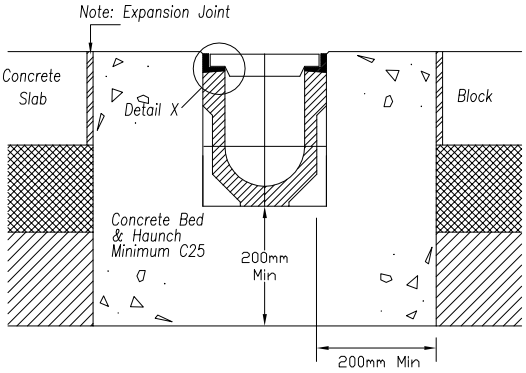
Rev.	Date	By	Details Of Revision



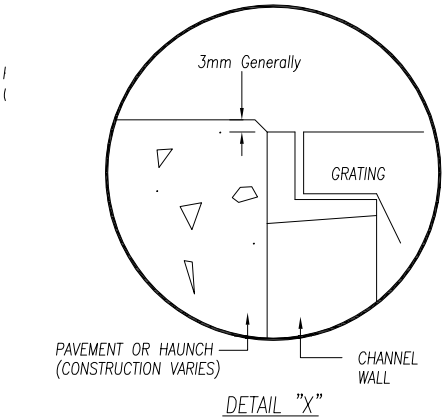
1. Wall
2. Screed
3. Reinforced concrete
4. Delta-MS500 drainage membrane
5. Delta-Plug+Delta-Rope OR Delta Qwik-Seal plug
6. Foamglass F anchor screwed into Delta plugs
7. FOAMGLASS T4+ (minimum 70mm) with joints sealed with PC?56 bituminous adhesive
8. Moisture resistant tapered edges plaster board / Eternit Hydropanel/ Fermacell - Apply three strips of PC?56 adhesive using 10 mm notched trowel
9. Bed insulation in PC?56 adhesive
10. FOAMGLASS FLOOR BOARD
11. Delta-MS20 drainage membrane
12. 1000 gauge Polyethelene separation membrane
13. Delta corner strip

DETAIL C

TYPICAL JUNCTION DETAIL:- NEW 100mm REPLACEMENT GROUND-BEARING SLAB/INTERFACE TO EX. WALLS IN NEW BATHROOM-UTILITY AREA IN BASEMENT VAULTS



DETAIL D



DETAIL "X"

TYPICAL SECTION THROUGH ACO-DECKLINE CHANNEL DRAIN

Architect: ANDREW COWAN ARCHITECTS

O'Reilly Design
Consulting Structural & Civil Engineers
45a Manor Road, West Ealing,
London,W13 0JA.
Tel: +44-2893-367554
Mobile +44-77979-693590
E-mail: topni@sky.com
www.oreillydesign.co.uk

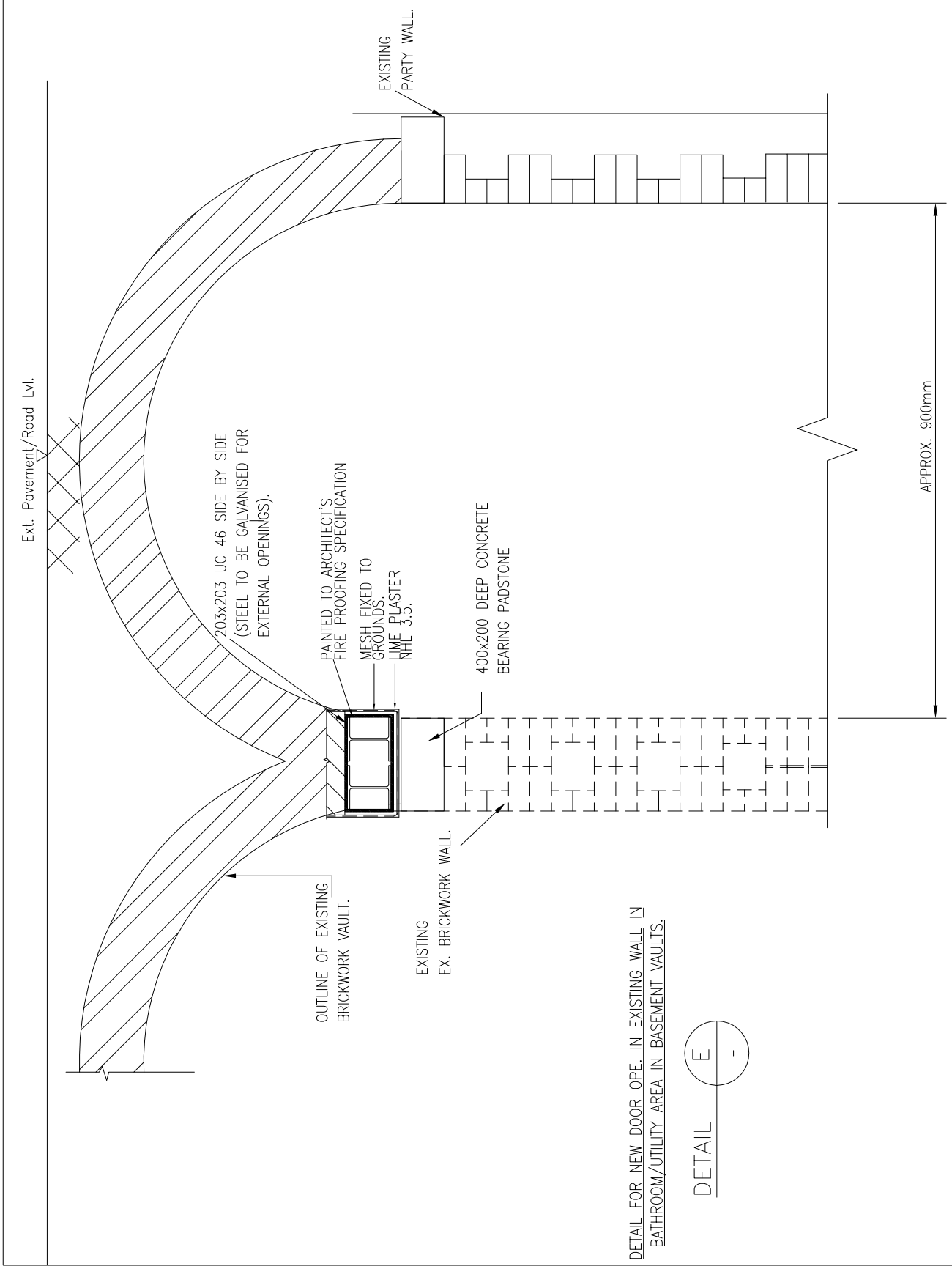
Ireland Office: 12 Old Shore Road, Carrickfergus,N.Ireland ,BT388TL

Project
RESIDENTIAL-REFURBISHMENT
4-CHALCOT-CRESCENT
PRIMROSE-HILL-LONDON-NW1.

Title
BASEMENT-FLOOR-REMEDIAL-DETAILS
SHEET-3

Drawing No. ORD/286/SK04
Drawn SO'R
Date FEB'17
Scale: N.T.S
Chk.

Rev.	Date	By	Details Of Revision



O'Reilly Design	Project No:	S-ORD-286	Memo Title: ASSESSMENT SURVEY- LISTED BUILDING No. 4 CHALCOT CRESCENT ,PRIMORE HILL, LONDON NW3.
Tel : 0797-9693590	Originator: SO'R		Date of Issue: 02-03-2017 Memo No: T001
Email : sean@oreilly design.co.uk	Sean O'Reilly: B.Sc(Hons) C.Eng,MIED,MIEI,ICIOB		

This Structural Impact Assessment Statement has been prepared as a corollary document to Andrew & Mann Architect, Listed Building Submission to London Borough of Camden for No. 4 Chalcot Crescent, Primrose Hill, London NW1 and details the impact of proposed structural works to the fabric of the property: -

1. Description of Existing Property and Proposed Works within House: -

The property is a 3-storey over basement terrace property located with the Primrose Hill Conservation Area (1971). The Crescent dates back to the mid 1850's (constructed by J. Burden) and apart from irregular geometry in places, is fairly of typical of Victorian construction methods the period (London Building Acts of 1844).

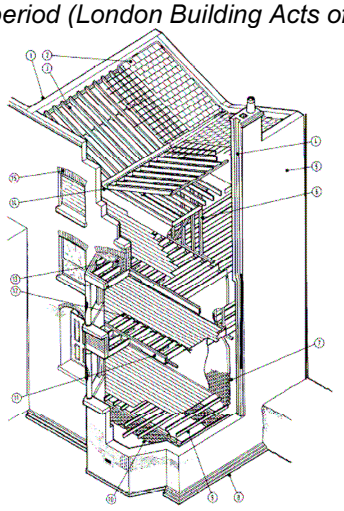


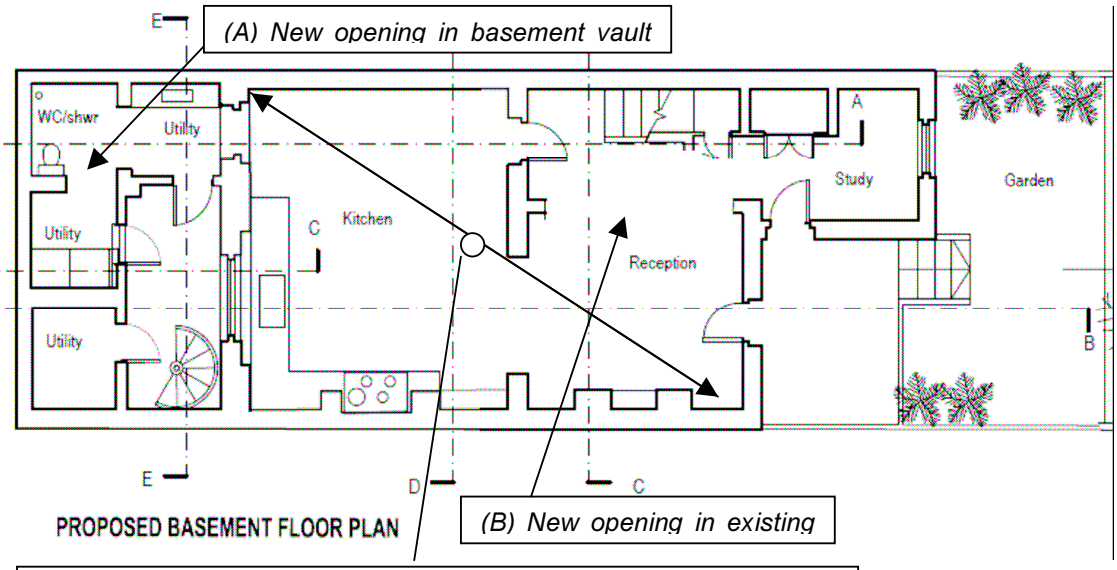
Figure 1 *Isometric view of typical Victorian terraced house*

Typical Victorian House construction methodology circa 1850.

Key
1. Party wall (neighbouring house beyond)
2. Slates or tiles on battens
3. Timber rafters
4. Flue in chimney
5. Brick flank or gable wall
6. Braced timber stud wall (as load-bearing spine wall)
7. Brick spine wall
8. Corbelled brick footing
9. Timber floor joists and boards
10. Dwarf or sleeper wall supporting joists
11. Trimmer joists
12. Herringbone strutting
13. Relieving arch
14. Valley beam
15. 'Flat' arch (normally with timber lintel behind)

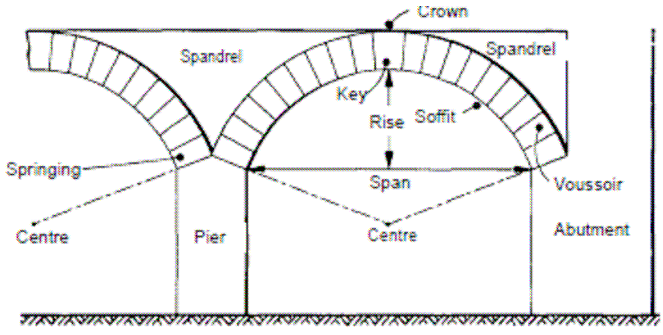
Typical of the street, No. 4 does not have any front garden but a light-well with railings and access stairwell leading to a number of under pavement brick vaults currently used as storage spaces. The intention is to refurbish these vaults and retrofit a W.C/ Shower area with a new opening to be created through the vault wall. It is proposed to create another wall opening within the Reception Room area in the basement.

2. Proposed Works within Basement Area: -



Ex. Floor Slab to be removed & new DPM & insulated slab installed.

The proposed works within the basement intention are as shown above and detailed on O'Reilly Design structural drawings SK01-SK04. The refurbishment works within the vaults will entail installing a new steel support beam over the new opening (A) just below the springing point of the arches; the vaults are located below the pedestrian footpath above at street level….a typical Victorian brick arched vault configuration is shown below. With careful temporary works back-propping and subsequent installation of the new steel support beams it is not anticipated that the vault structure or it's capacity will be compromised in any way. Site trial pits will confirm the existing foundation configuration but it is anticipated that they will comprise corbelled brickwork with a bearing level approx.450mm below existing over-site slab level. In the event of existing poor foundations prevailing localised underpinning of the existing vault wall would be proposed at the beam bearing positions: -



It is also intended to install a new waterproofed and insulated slab construction within the vault areas to create a modern usable space (W.C/ Shower and Utility area). It is intended to use a thin fibre-mesh concrete slab construction along with a thin high performance insulation to minimise the depth of the overall construction and therefore not compromise existing foundation levels. A new modern insulated slab construction with damp proof system is also proposed within the main basement area in the house proper. It is not anticipated that the overall new slab thickness will

compromise the integrity or capacity of the existing foundations—see extract from London Building Acts 1844 requirements below:-

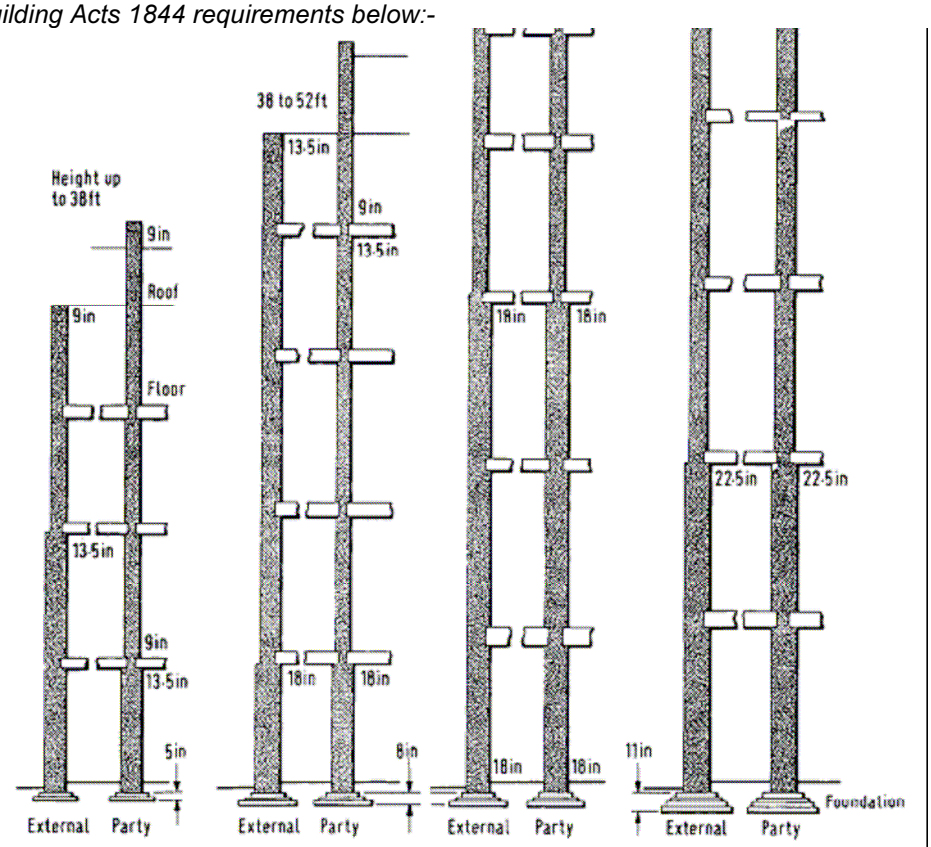


Figure 6 *Thickness of walls in accordance with the London Building Acts of 1844*

It is also proposed to create another wall opening (B) within the main house in the Living Room area. Site investigation works indicate that the new opening appears to be have been lightweight stud framing infilled some time in the past. The works for the opening therefore should simply entail removing this non-structural infilling and making good. In the event of the existing head trimmer being deemed inadequate structural stiffening of the trimmer would be undertaken rather than installing a new beam.

place, a thixotropic non-shrink grout "Helibond" is pumped into the chase line to bond the tie-bar into the existing wall. Helifix have used this system successfully on numerous historic and listed buildings across London and Case-Study data is available for such projects: -

PRODUCT SHEET – PS/HB01

HELIFIX
SUSTAINABLE STRUCTURAL SOLUTIONS

HeliBar

Helical stainless steel reinforcing bar for masonry repair and strengthening in both remedial and new build situations

Applications

- Crack stitching
- Lintel repair and creation
- Forming deep masonry beams
- Horizontal structural restraint (when used with BowTie systems)
- Reconnecting separated walls
- Securing parapet walls
- Support existing masonry when creating new openings
- Creating movement joints
- Reinforcing new build masonry
- Seismic upgrades for existing masonry
- Repairing bridges, tunnels and arches

Crack stitching

Lintel reinstatement

Reconnecting separated walls

Securing parapet walls

Over 100 standard repair specifications are available online, covering all common structural faults
Relevant Repair Details: BW01 & BW02; CS01 to CS14 (except 4, 7, 9, 11 & 12); LB01 to LB05; LR01 to LR11; MA03 to MA05; MJ01 to MJ03; PW01 to PW03; RB06; RF07 & RF09; RW01, 3 & 6;

For full Product Information, Case Studies and downloadable Repair Details go to:
www.helifix.co.uk/products/remedial-products/helibar

Features

- Austenitic stainless steel helical bars
- Combines great axial strength with flexibility
- Accommodates differential building movement
- No additional stresses introduced into structure
- Generates high tensile strength with mortar (new build only) or HeliBond grout
- Extremely economical compared with alternative methods
- May remove or reduce the need for mass underpinning
- Fully concealed once installed
- Avoids expensive taking down and rebuilding
- Minimal disruption to building's fabric or occupants
- Spreads structural loads to avoid secondary cracking
- Reduces the potential for cracking in shrinkable materials

HeliBar is inserted into HeliBond grout within a cut slot

Sean O'Reilly

Sean O'Reilly-Chartered Engineer
Eur Ing,C.Eng,B.Sc.(Hons),MIED,MIEI,ICIOB
O'Reilly Design Ltd.

NOVOCON® XR

PRODUCT DATA SHEET

SPECIFY NOVOCON® XR FIBERS:

- FOR TEMPERATURE/ SHRINKAGE AND FLEXURAL REINFORCEMENT
- INCREASED CRACK RESISTANCE, DUCTILITY, ENERGY ABSORPTION OR TOUGHNESS
- IMPROVED IMPACT RESISTANCE
- IMPROVED FATIGUE ENDURANCE AND SHEAR STRENGTH
- IMPROVED DURABILITY

NOVOCON® XR STEEL FIBERS

Novocon XR (formerly Xorex®) steel fiber is a leading low carbon, cold drawn steel wire fiber concrete reinforcement. It is evenly distributed in concrete mixtures to provide improved mechanical bonding capacity exceeding most performance specifications for enhancing concrete's shear strength, fatigue endurance, impact resistance and flexural toughness. Novocon XR has been used in over 150 million square feet (15 million square meters) of slabs on ground for industrial floors. It is a reliable, cost efficient concrete reinforcement that is designed to be easy to mix, place and finish..

FEATURES & BENEFITS

- Complies with ASTM A820.
- Variable equivalent diameter and a continuously deformed shape provide reinforcement resulting in tighter, more stable joints.
- Improves the impact resistance, fatigue endurance and shear strength of concrete.
- Provides crack width control.
- Manufactured in 1.5 in and 2 in (38 mm and 50 mm) lengths to meet specific applications.
- Provides uniform, multi-directional concrete reinforcement.
- Requires less labor to incorporate into concrete applications than rebar or wire mesh.
- Offers greater project scheduling accuracy. • No special equipment is needed to mix, place or finish. • Compatible with all types of cements and concrete mixtures.
- Backed by our team of concrete experts who carefully analyze each project and provide steel fiber design recommendations to help ensure maximum product performance and cost efficiency.

COMPLIANCE

- Novocon XR steel fiber concrete reinforcement complies with ASTM A820.
- Materials, batching requirements, mixing and testing procedures should comply with the applicable sections of ASTM C 1116/C 1116M and ASTM C 1436.

PRIMARY APPLICATIONS

- Commercial and Industrial Slabs On Ground
- Shotcrete
- Composite Metal Decks
- Overlays
- Airport Pavements
- Highway Pavement
- Hydrodynamic Structures
- Equipment Foundations
- Precast

CHEMICAL AND PHYSICAL PROPERTIES

Fiber Length	1.5inand2in(38mmand50mm)Equivalent
Diameter	0.045" (1.14 mm)
Aspect Ratio	34 and 44
Tensile Strength	140-180 Kpsi (966-1242 MPa)
Deformation	Continuously deformed circular segment
Appearance	Bright and clean wire

NOVOCON® XR

PRODUCT DATA SHEET

PRODUCT USE

MIXDESIGNSANDPROCEDURES:Novocon® XRsteelfibercan be added before, during or after the batching of the concrete. Materials, batching requirements, mixing and testing procedures should comply with the applicable sections of ASTM C 1116/C 1116 M and ASTM C 1436.

PLACING: Novocon XR steel fiber reinforced concrete can be pumped and placed using conventional equipment, including shotcrete equipment. Hand screeds, laser screeds and vibratory screeds can be used.

FINISHING: Conventional finishing techniques and equipment can be used when finishing Novocon XR steel fiber concrete. In some cases an extra bull float process is advised and lowering the angle of the floating blades will help to minimize fiber exposure on

the surface. Propex Concrete Systems personnel can help to determine the best solution for you

APPLICATION RATE: The fiber dosage will vary depending on the type of application, concrete mix design and the performance/ toughness requirements of each particular project. Typically, steel fiber dosage will be in the range of 25 lbs to 100 lbs per cubic yard (15 kg to 60 kg per cubic meter). Propex Concrete Systems technical staff can offer advice on dosage requirements once performance requirements have been established by the project designer/engineer.

SAFETY

It is recommended that gloves and eye protection be used when handling or adding Novocon XR steel fiber to concrete.

COMPATIBILITY

Novocon XR steel fibers are compatible with all liquid and mineral admixtures, curing compounds, hardeners and coatings.

PACKAGING & STORAGE

Novocon XR steel fiber is packaged in 55 lb (25 kg), five-ply, paper and polyethylene lined bags. 40 bags per pallet.

TECHNICAL SERVICES

Propex is backed by our team of reinforced concrete specialists who can carefully analyze each project and provide fiber reinforced concrete design solutions to ensure maximum project performance and cost efficiency.

REFERENCE DOCUMENTS

- ASTM A 820 Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- ASTM C 94/C 94M Standard Specification for Ready-Mixed Concrete.
- ASTM C 1116/C 1116 M Standard Specification for Fiber-Reinforced Concrete.
- ASTM C 1399 Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
- ASTM C 1436 Standard Specification for Materials for Shotcrete.
- ASTM C 1550 Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel).
- ASTM C 1609/C 1609M Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading).
- JCI-SF4 Method of Test for Flexural Strength and Flexural Toughness of Fiber-Reinforced Concrete.
- ACI 304 Guide for Measuring, Mixing,Transporting and Placing Concrete.
- ACI 506 Guide for Shotcrete.
- ACI 544-3R Guide for Specifying, Proportioning, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

UL® Classified: Type Novocon Steel Fibers for use as an alternate or in addition to the welded wire fabric used in Floor-Ceiling D700, D800, D900 Series Designs. Fibers may also be used in Design Nos. G256, G514. Fibers added to concrete mix at a rate of 10 to 50 lb of fiber for each cubic yard of concrete.

SPECIFICATION CLAUSE

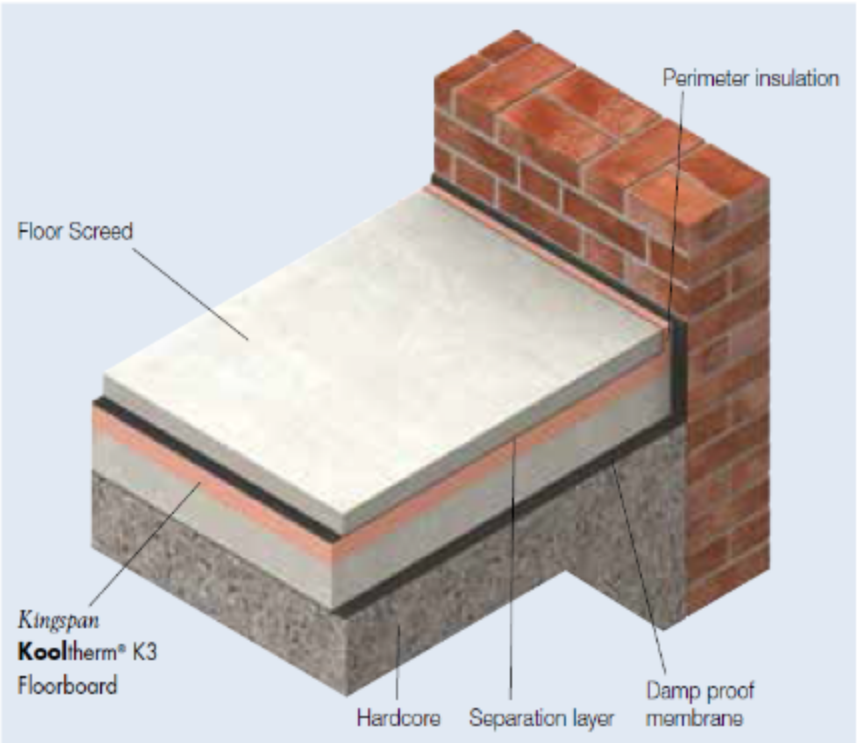
Fibers for concrete shall be Novocon XR.....inch steel fibers conforming to ASTM A820, Type V, Deformed with a minimum tensile strength of 140-180 Kpsi (966-1242 MPa). Unless otherwise stated, Novocon XR steel fibers should be added to the concrete at a rate of.....lbs/yd3 and mixed for sufficient time (75 rotations at a full mixing speed) to ensure uniform distribution of the fibers throughout the concrete. Steel fibers shall be manufactured by Propex Concrete Systems, 6025 Lee Highway, Suite 425, PO Box 22788, Chattanooga,TN 37422, USA, tel: 423 892 8080, fax: 423 892 0157, web site: fibermesh.com.

Propex™ Fibermesh

NORTH AMERICA
Propex Operating Company, LLC
6025 Lee Highway, Suite 425
Chattanooga, TN 37421
Tel: 800 621 1273
Tel: 423 892 8080
Fax: 423 892 0157

INTERNATIONAL
Propex Concrete Systems Ltd.
Propex House
9 Royal Court, Basil Close
Chesterfield, Derbyshire, S41 7SL
United Kingdom
Tel: +44 (0) 1246 564200
Fax: +44 (0) 1246 465201

Replacement Concrete Floor



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.25	0.18	0.15
Kingspan **Kool**therm® K3 Floorboard	50	90	110
Kingspan OPTIM-R™ Flooring System*	25	35	50
EPS (0.032 W/m·K)	75	125	155
XPS (0.029 W/m·K)	70	125	140

Figures based on a P/A ratio of 0.5

* The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 15%. The build-up may be made up of two layers of insulation.

Insulation

Second Issue March 2015

Domestic Refurbishment

Kingspan®

Low Energy –
Low Carbon Buildings

Introduction

Most of the buildings we see around us today were designed and built long before energy conservation, carbon saving and rocketing energy prices were foreseen. As a consequence, those buildings use more energy than their modern equivalents, cost more to run and cause more carbon dioxide emissions.

It is also well known and well documented that solutions and systems exist to refurbish older buildings, improve their thermal performance and reduce their energy consumption.
The consensus of opinion is that a building's fabric should be made more thermally efficient, and airtight, before other energy reduction or energy generation measures are considered.
All elements of a building's fabric can be upgraded to meet current Building Regulations and Standards. However, it is the UK's 6.6 million uninsulated solid walled homes that offer the most significant opportunity for improvement.

This document will concentrate on the refurbishment of domestic properties, by examining relevant regulations, voluntary standards and incentives, potential construction solutions, and finally a number of case studies where improvements to a building's fabric have been made.

Regulations, Voluntary Standards & Incentives

Regulations – England, Wales and Scotland

Introduction

Guidance on how to meet the energy efficiency requirements of the Building Regulations / Standards, when refurbishing / renovating existing dwellings in Great Britain, are detailed in 2013 editions of Approved Documents L1B for England, published by The Department for Communities & Local Government (DCLG); 2014 editions of Approved Document L1B for Wales, published by the Welsh Government (Llywodraeth Cymru); and the 2013 and 2015 editions of Technical Handbook Section 6 Domestic – Energy for Scotland, published by the Scottish Government (Riaghaltas na h-Alba).

All three documents class renovations as the following activities:

- cladding or rendering the external surface of a thermal element;
- dry-lining the internal surface of a thermal element;
- stripping a thermal element down to expose the basic structural components (brick / block, timber / metal frame, joists, rafters etc.) and then rebuilding the element; and
- replacing the water proof membrane on a flat roof.

The requirements are triggered when the area to be refurbished / renovated is greater than 50% of the surface area of an individual element, or 25% of the total building envelope area. When assessing the former percentage, the area of the element should be taken as that of the individual element, not all of the elements of that type in the dwelling. The area of the element should also be interpreted in the context of whether the element is being refurbished / renovated from the inside or outside. For example: if removing all of the plaster from the inside of a wall, the area of the element is the external wall area of the room; or if removing external render from the outside of the wall, it is the area of the whole wall elevation.

If the requirements are triggered the documents detail specific U-value requirements for refurbished / renovated elements. However, these U-values may be relaxed if:

- the simple payback term is longer than 15 years;
- the usable floor space is reduced by 5% or more; or
- the work is not otherwise technically or functionally feasible.

This document focusses on the U-values given in: the 2013 edition of Approved Document L1B for England; the 2014 edition of Approved Document L1B for Wales; and the 2015 of Technical Handbook Section 6 Domestic – Energy for Scotland. The required U-values given in each document are shown in the tables below.

Approved Document L1B, 2013 Edition

Element	New or Replacement Thermal Elements U-value (W/m²·K)	Renovation of Thermal Elements U-value (W/m²·K)
Pitched roofs - insulation at ceiling level	0.16	0.16
Flat roof or roof with integral insulation	0.18	0.18
Walls – external or internal insulation	0.28	0.30
Floors	0.22	0.25

Approved Document L1B, 2014 Edition

Element	New or Replacement Thermal Elements U-value (W/m²·K)	Renovation of Thermal Elements U-value (W/m²·K)
Lofts	–	0.16
All other roofs	0.15	0.18
Walls – external or internal insulation	0.21	0.30
Floors	0.18	0.25

Technical Handbook Section 6 2011 Edition, Domestic - Energy

Element	Extensions where existing dwelling walls and roof are worse than 0.70 and 0.25 respectively U-value (W/m²·K)	Other extensions; Upgraded existing elements and non-exempt conservatories U-value (W/m²·K)
Pitched roof – insulation at ceiling level	0.13	0.15
All other roofs	0.15	0.18
Walls – external or internal insulation	0.19	0.22
Floors	0.15	0.18

Technical Handbook Section 6 2015 Edition, Domestic - Energy

Element	Extensions where existing dwelling walls and roof are worse than 0.70 and 0.25 respectively U-value (W/m²·K)	Other extensions; Upgraded existing elements and non-exempt conservatories U-value (W/m²·K)
Pitched roof – insulation at ceiling level	0.11	0.15
All other roofs	0.13	0.18
Walls – external or internal insulation	0.17	0.22
Floors	0.15	0.18

Technical Handbook, Domestic Section 6 – Energy

Recognises that certain constructions are easier to upgrade than others. It states that a building in a ruinous state should, after renovation, be able to achieve almost the level expected of a new construction. It may not however be reasonably practicable for a dwelling, which is in a habitable condition, to have its internal space significantly reduced, either in area or height, in order to accommodate insulation; or for excessive alterations to be caused by the fitting of external thermal insulation, unless the owner / occupier of the dwelling intends these changes to be made. It further comments that, in the majority of cases, after an alteration of this nature to the insulation envelope, a roof should be able to achieve at least an average U-value of 0.35 W/m²·K and in the case of a wall or floor an average U-value of 0.70 W/m²·K.

Voluntary Standards

Passivhaus and EnerPHit

There is a growing alternative to the thermal performance requirements set out in national Regulations. Called 'Passivhaus', it requires that buildings use very little energy for heating or cooling, whilst providing a high level of comfort for the occupants. Attention to detail, rigorous design and construction and an exacting certification process ensure that what is designed is built, and what is built performs as it was designed. EnerPHit, a slightly modified version of the Passivhaus standard for the refurbishment of existing buildings, has been developed with slightly more generous standards. It requires:

- specific heat demand of ≤ 25 kW.h/m²/yr;
- primary energy demand of ≤ 120 kW.h/m²/yr;
- roof, wall and floor U–values of ≤ 0.15 W/m²·K;
- windows and doors (including frame and glazing) U–values of ≤ 0.8 W/m²·K;
- thermal bridging psi values to be less than 0.01 W/m²·K;
- whole house mechanical ventilation with heat recovery (MVHR) that is ≥ 75% efficient and exhibits a specific fan power of ≤ 0.45 W.h/m³; and
- air–leakage of ≤ 1.0 ach at 50 Pa.

Unlike the Building Regulations in England & Wales and the Building Standards in Scotland, where no account is made of airtightness or thermal bridging, the EnerPHit standard places great emphasis on these factors, to improve the efficiency of the building fabric. Mechanical Ventilation with Heat Recovery (MVHR) is used to ensure a steady supply of fresh air within buildings renovated to this standard, because of the low level of air–leakage that is required.

Kingspan Insulation is a founding member of the Passivhaus Trust. More information can be found by visiting www.passivhaustrust.org.uk.

Incentives

Green Deal and ECO

The Green Deal represents arguably the most radical shake–up to the large–scale refurbishment of existing properties. It offers owner occupiers, the private and social rented sectors and the commercial sector the opportunity to install, among other things, building fabric measures on properties frequently termed 'hard to treat'.

It works by effectively eliminating the need for a customer to pay upfront for a package of energy efficiency measures from a 'Green Deal Provider'. The cost of the measures (the Green Deal Finance) should be covered by savings on the electricity bill over, for example, 25 years. There is a 'Golden Rule' that this charge on the electricity bill should not exceed the expected savings and the length of the repayment period should not exceed the expected lifetime of the measure.

ECO (the Energy Company Obligation) has taken over from the previous obligations of CERT and CESP. ECO will work hand–in–hand with the Green Deal, to help those households where the 'Golden Rule' can not otherwise be met, by focusing on hard to treat properties and vulnerable and poor households.

To support the expected industry expansion, re–skilling of existing installers is required together with a major recruitment and training drive to attract new people into the industry. To this end, the Solid Wall Insulation Guarantee Agency (SWIGA) developed a robust quality framework supporting new skills and training independently assessed via a third party inspection scheme resulting in a 25 year guarantee to provide consumers, specifiers and funding organisations the peace of mind needed when installing solid wall insulation, under both the Green Deal and ECO.

Refurbishment Solutions

Set out in the following pages, are constructions, using Kingspan Insulation products, which are designed to meet the current England, Wales and Scotland U–values. These U–values are valid for the constructions shown in the details immediately above. Also shown, is a range of alternative solutions that other insulation manufacturers might offer. Please contact the Kingspan Insulation Technical Service Department (see rear cover) if you require similar calculations for other constructions.

U–values have been calculated using the methods detailed in BS EN ISO 6946: 2007 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method), BS EN ISO 13370: 1998 (Thermal performance of buildings. Heat transfer via the ground. Calculation methods), and using the conventions set out in BR443 (Conventions for U–value calculations). 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 and a condensation risk analysis should be completed for each project. Please contact the Kingspan Insulation Technical Service Department (see rear cover) or visit our website www.kingspaninsulation.co.uk.

Flat Roof Insulation

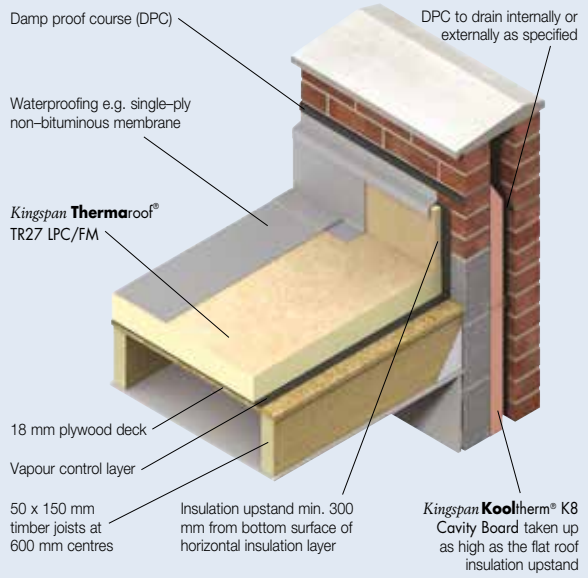
Trigger Points & Timing

- Should be considered when repairing or replacing the waterproofing membrane on a roof.
- Should be considered, even when no other work was intended, if a roof is uninsulated or underinsulated.

Benefits

- Can reduce heating bills and / or increase thermal comfort.
- As the insulation is above the roof deck, head room in habitable space below is not affected.
- Work can be carried out without the need for building occupants to be moved.

Timber Deck



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.18	0.15	0.13
Kingspan **Therma**roof® TR27 LPC/FM	120	145	170
Kingspan OPTIM-R™ Roofing System** (+ *Kingspan* **Therma**roof® TR27 LPC/FM overlay)	50 + (25)	60 + (25)	75 + (25)
Rock Mineral Fibre (0.038 W/m·K)*	185	220	270

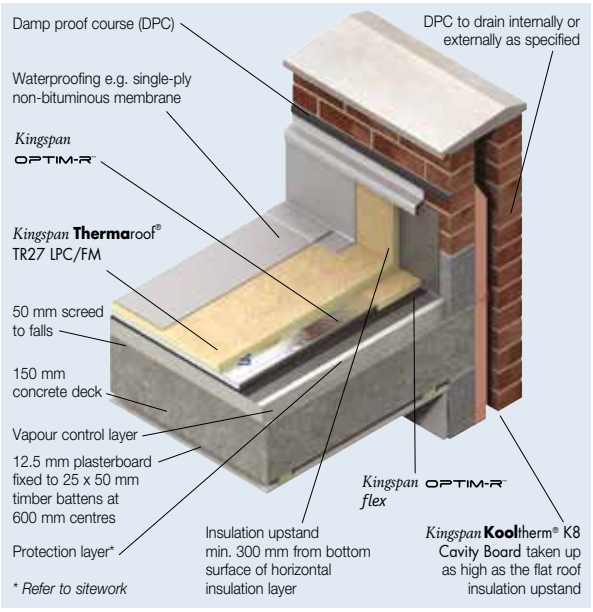
These calculations assume telescopic tube fasteners with a thermal conductivity of 1.00 W/m·K or less, the effect of which is insignificant.

The ceiling is taken to be a 3 mm skim coated 12.5 mm plasterboard with a cavity between it and the underside of the deck.

* May be made up of two layers of insulation.

** The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 30%. The build-up may be made up of two layers of insulation.

Dense Concrete Deck



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.18	0.15	0.13
Kingspan **Therma**roof® TR27 LPC/FM	120	145	170
Kingspan OPTIM-R™ Roofing System** (+ *Kingspan* **Therma**roof® TR27 LPC/FM overlay)	50 + (25)	60 + (25)	75 + (25)
Rock Mineral Fibre (0.038 W/m·K)*	185	220	270

These calculations assume telescopic tube fasteners with a thermal conductivity of 1.00 W/m·K or less, the effect of which is insignificant.

The ceiling is taken to be a 3 mm skim coated 12.5 mm plasterboard with a cavity between it and the underside of the deck.

* May be made up of two layers of insulation.

** The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 30%. The build-up may be made up of two layers of insulation.

Why Kingspan Insulation?

- *Kingspan* OPTIM-R™ **Roofing System** is the thinnest possible solution to insulation problems.
- Greater thicknesses of flat roof insulation may run into practical difficulties related to the available upstand height at parapets, abutments and rooflights.
- The thicknesses of *Kingspan* **Therma**roof® TR27 LPC/FM shown are available in one board. The alternatives may require a double layer of insulation which will increase installation time and cost.
- *Kingspan* **Therma**roof® TR27 LPC/FM is considerably lighter than the equivalent thickness of rock mineral fibre, with potential implications for the structural design of buildings and manual handling during installation.

Refurbishment Solutions

Balcony & Terrace Insulation

Trigger Points & Timing

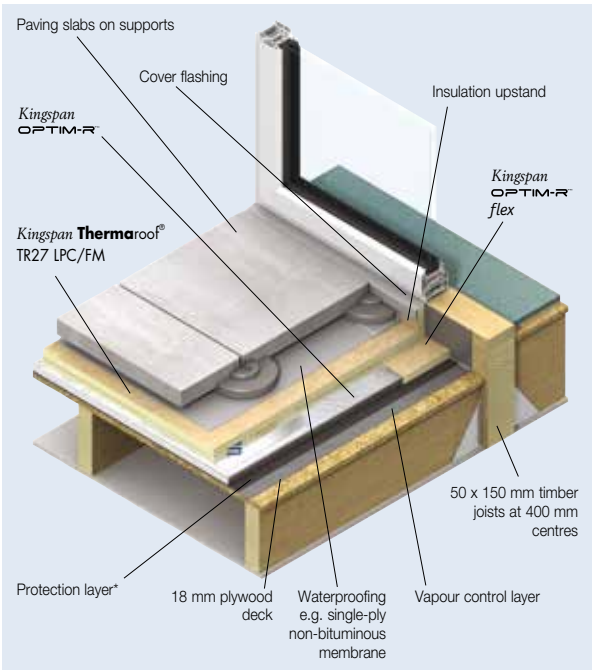
- Should be considered when repairing or replacing the waterproofing membrane on a balcony or terrace.
- Should be considered when laying a new balcony or terrace.
- Should be considered, even when no other work was intended, if a balcony or terrace is uninsulated or underinsulated.

Benefits

- Can reduce heating bills and / or increase thermal comfort.
- As the insulation is above the roof deck, head room in habitable space below is not affected.
- Work can be carried out without the need for building occupants to be moved.

Timber Deck

Timber Deck with Plasterboard Ceiling and *Kingspan* **Therma**roof® TR27 LPC/FM **Overlay**



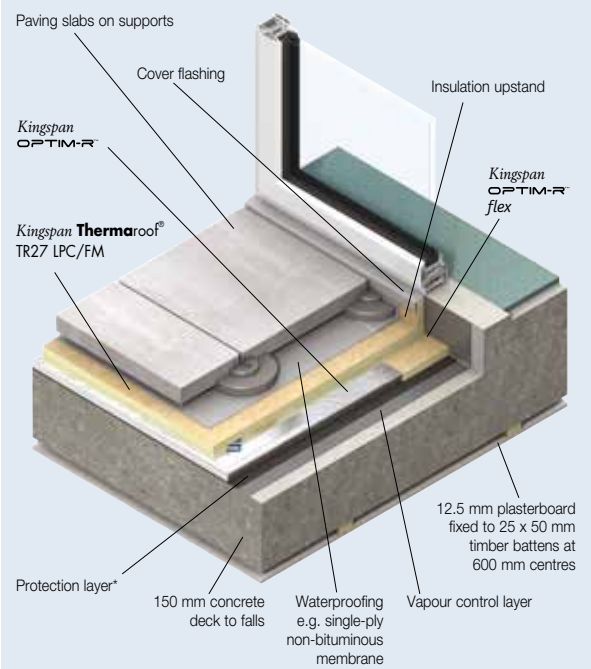
* *Refer to Sitework*

	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.18	0.15	0.13
Kingspan OPTIM-R™ Balcony & Terrace System* (+ *Kingspan* **Therma**roof® TR27 LPC/FM overlay)	50 + (25)	60 + (25)	75 + (25)
EPS	185	225	260
XPS	140	170	200

* The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 30%.

Concrete Deck

Dense Concrete Deck with Suspended Ceiling and *Kingspan* **Therma**roof® TR27 LPC/FM **Overlay**



* *Refer to Sitework*

	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.18	0.15	0.13
Kingspan OPTIM-R™ Balcony & Terrace System* (+ *Kingspan* **Therma**roof® TR27 LPC/FM overlay)	50 + (25)	65 + (25)	75 + (25)
EPS	190	230	265
XPS	145	175	205

* The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 30%.

Why Kingspan Insulation?

- *Kingspan* OPTIM-R™ **Balcony & Terrace System** is the thinnest possible solution to insulation problems.
- *Kingspan* OPTIM-R™ **Balcony & Terrace System** can maintain an even transition between indoor and outdoor levels.

External Wall Insulation

Trigger Points & Timing

- Should be considered when rendering or re–rendering the outside of a property.
- Can be carried out at any time – no need to decant occupants.
- Windows and doors may need replacing at the same time, or before the installation of the insulation because of the detailing required at reveals.
- Should be considered, even when no other work was intended, if a wall is uninsulated or underinsulated.

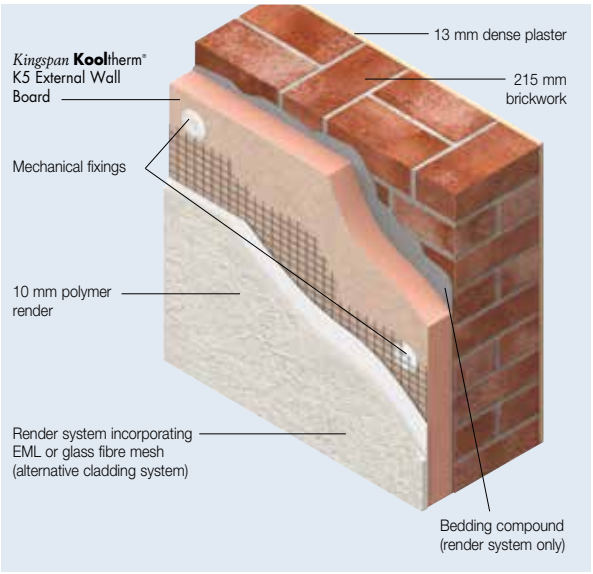
Benefits

- Can reduce heating bills and/ or increase thermal comfort.
- Arguably the best method of insulating a solid wall as it gives far greater insulation continuity than internal wall insulation – there is no thermal bridging where external walls meet internal walls and floors.
- Does not reduce floor space.
- Building occupants can be left in–situ without having to move out of the building or into a different room.
- The broad range of external wall insulation finishes, including renders of different colours, brick slips, traditional timber cladding or tile or slate hanging, could significantly improve the appearance of a property.
- Can be used in combination with internal wall insulation as part of a 'hybrid' approach – for example using it on the side and rear elevations of a property with internal wall insulation on the front elevation.
- Can improve the rain and wind–resistance of a property.
- The thermal mass of the masonry remains exposed.

Likely to be the most acceptable solution to refurbishing the wall if the wall is being re–rendered or rendered for the first time or if there is a free choice between external wall insulation and internal wall insulation. It should also be considered if the wall is to be re–plastered but internal space constraints prohibit the application of internal dry lining.

Solid Brick Wall

Although the data below relates to solid brick walls, external wall insulation can be installed just as readily on solid dressed stone and precast concrete walls. It can also be installed on cavity walls that can't be filled with cavity wall insulation, or that have already been filled with cavity wall insulation, but require further improvement.



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown			
U–value ($W/m^2 \cdot K$)	0.30	0.22	0.17	0.15
Kingspan **Kool**therm® K5 External Wall Board	55	80	110	120
Kingspan OPTIM-R™ External Wall System*	30	45	60	70
Rock Mineral Fibre (0.038 W/m·K)**	105	150	200	225
EPS (0.032 W/m·K)	90	125	170	190

* The *Kingspan* OPTIM-R™ **External Wall System** is overlaid with a magnesium silicate render carrier board. This is mechanically fixed through the appropriate horizontal or vertical *Kingspan* OPTIM-R™ *fix* panels using carbon steel fasteners with e cross-sectional area of 7.44mm², with 2.88 fasteners per m². The bridging effect of the *Kingspan* OPTIM-R™ *flex* and *Kingspan* OPTIM-R™ *fix* components of the System is taken as 30%.

Why Kingspan Insulation?

- *Kingspan* **Kool**therm® offers the thinnest commonly used solution.
- Greater thicknesses of external wall insulation will require longer and more costly fixings, trims and accessories.
- Greater thicknesses of external wall insulation will mean a greater reveal depth, reducing natural daylight.
- Greater thicknesses of external wall insulation may run into practical difficulties related to the available depth of eaves overhangs, encroachment into access routes and the creation of unsightly steps between adjacent insulated and uninsulated walls.
- It is likely to be more cost effective to use a thinner, high performance insulation material than to extend the eaves to make space for a thicker, low performance insulation material.

Internal Wall Insulation

Trigger Points & Timing

- Should be considered when re–plastering, modernising, re–decorating, re–plumbing, re–wiring or fitting new kitchens or bathrooms.
- Best done when property is empty e.g. between tenants or upon purchase.
- If the property can't be vacated, then best done room by room.
- Should be considered, even when no other work was intended, if a wall is uninsulated or underinsulated.

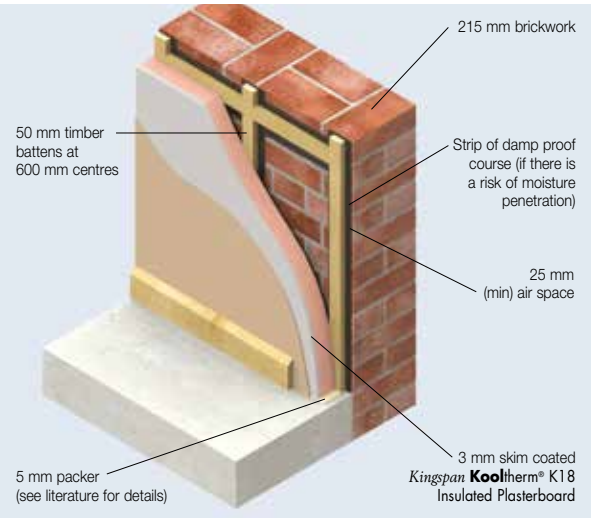
Benefits

- Can reduce heating bills and / or increase thermal comfort.
- No impact on the external appearance of the building.
- Ideal if external wall insulation cannot be used because the building is in a conservation area, the building owner prefers the existing aesthetic, or where local planning constraints exist.
- Can be used in conjunction with external wall insulation as part of a 'hybrid' approach – for example using it on the front elevation of a property with external wall insulation on the side and rear elevations.
- Rooms heat up more quickly as the insulation is close to the internal surface of the room.

Likely to be the most acceptable solution to refurbishing the wall if the wall is being re–plastered or if the wall is to be re–rendered but external space constraints or aesthetics prohibit the application of external insulation.

Solid Brick Wall

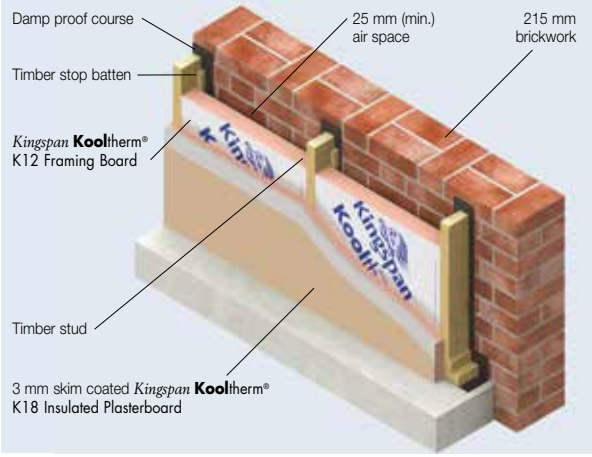
Although the data below relates to solid brick walls, internal wall insulation can be installed just as readily on solid stone and precast concrete walls.



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value ($W/m^2 \cdot K$)	0.30	0.22	0.17
Kingspan **Kool**therm® K18 Insulated Plasterboard	62.5	92.5	122.5
Glass Mineral Fibre (0.038 W/m·K)	Requires installation on stud work. See opposite.		

All calculations assume a 15% bridging factor. The thermal conductivity of the timber has been assumed to be 0.12 W/m·K.

Kingspan **Kool**therm® K18 Insulated Plasterboard contains an integral vapour control layer in order to minimise the risk of condensation. *Kingspan* **Kool**therm® K18 Insulated Plasterboard product thickness = insulant thickness + 12.5 mm plasterboard.



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown			
U–value ($W/m^2 \cdot K$)	0.30	0.22	0.17	0.15
Kingspan **Kool**therm® K12 Framing Board*	75***	75 + 37.5 **Kool**therm® K18 Insulated Plasterboard	75 + 62.5 **Kool**therm® K18 Insulated Plasterboard	75 + 72.5 **Kool**therm® K18 Insulated Plasterboard
Glass Mineral Fibre (0.038 W/m·K)**	140***	140 + 37.5 **Kool**therm® K18 Insulated Plasterboard †	140 + 62.5 **Kool**therm® K18 Insulated Plasterboard †	140 + 72.5 **Kool**therm® K18 Insulated Plasterboard

All calculations assume a 15% bridging factor. The thermal conductivity of the timber has been assumed to be 0.12 W/m·K.

* Calculations assume 100 mm deep timber studwork with a 25 mm timber batten cavity.

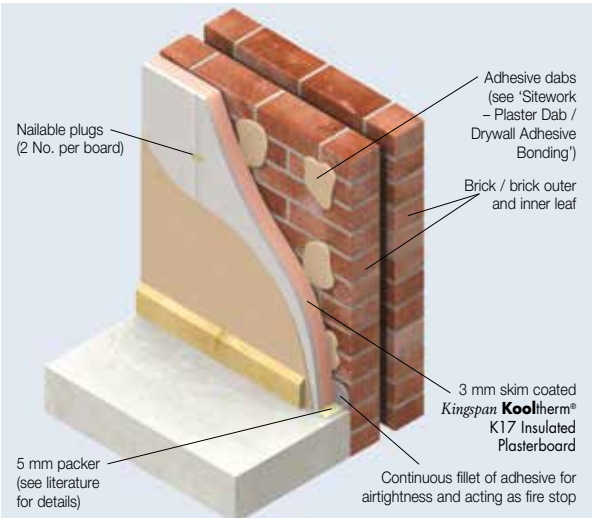
** The example assumes 140 mm deep studwork to accommodate the different type and thickness of insulation material with no batten cavity.

*** Calculations which feature insulation between studwork only, assume the use of 15 mm plasterboard and a polythene sheet vapour control layer in order to minimise the risk of condensation

† *Kingspan* **Kool**therm® K18 Insulated Plasterboard contains an integral vapour control layer in order to minimise the risk of condensation. *Kingspan* **Kool**therm® K18 Insulated Plasterboard product thickness = insulant thickness + 12.5 mm plasterboard.

Cavity Wall

Although this document relates predominantly to solid walls, solid wall insulation solutions can also be installed on cavity walls that can't be filled with cavity wall insulation, or that have already been filled with cavity wall insulation but require further improvement. In this case, it would be more common to install insulated plasterboard using dot and dab fixing or adhesive bonding.



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value ($W/m^2 \cdot K$)	0.30	0.22	0.17
Kingspan **Kool**therm® K17 Insulated Plasterboard	62.5	87.5	72.5
Rock Mineral Fibre (0.038 W/m·K)	Requires installation on stud work.		

Calculations assume two leafs of 102.5 mm brickwork with a 50 mm unfilled cavity.

* Calculations assume *Kingspan* **Kool**therm® K17 Insulated Plasterboard product thickness = insulant thickness + 12.5 mm plasterboard on 15 mm plaster dabs.

Why Kingspan Insulation?

- *Kingspan* **Kool**therm® offers the thinnest commonly used solution.
- Greater thicknesses of internal wall insulation may result in unacceptable floor space reduction.

Floor Insulation

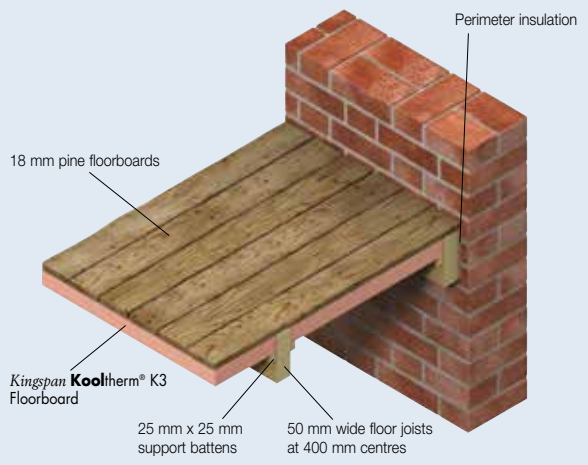
Trigger Points & Timing

- Should be considered when laying a concrete floor or improving a traditional floor – such as traditional tiles on earth.
- Should be considered when installing pipework or new plumbing under a floor – essential when installing under floor heating.
- Should be considered when laying a new timber floor or replacing broken or faulty floor boards or replacing carpets.
- Should be considered, even when no other work was intended, if a floor is uninsulated or underinsulated.

Benefits

- Can reduce heating bills and / or increase thermal comfort.
- Floor insulation will help reduce heat loss through the ground – an area which is frequently overlooked.
- If installed correctly it can help reduce thermal bridging at floor/wall junctions

Suspended Timber Ground Floor



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.25	0.18	0.15
Kingspan **Kool**therm® K3 External Floorboard*	80	130	80+90**
Kingspan OPTIM-R™ Flooring System***	25	35	50
Rock Mineral Fibre (0.038 W/m·K)****	120	190	–
EPS (0.032 W/m·K)	105	170	–

Figures based on a P/A ratio of 0.5

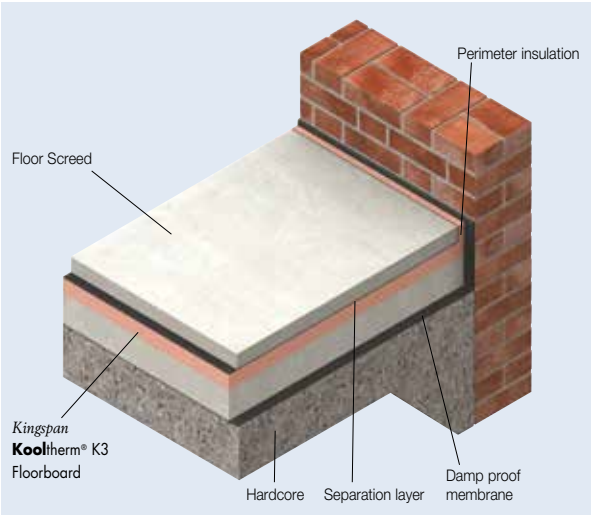
* Suspended timber ground floor joists are typically 200 mm deep and therefore U–values have been calculated with a maximum insulation thickness of 175 mm in order to accommodate 25 x 25 mm timber support battens.

** Where multiple layers of insulation of different thicknesses are used, the thickest layer should be installed as the outermost layer in the construction.

*** The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 15%. The build-up may be made up of two layers of insulation.

**** To support mineral fibre netting should be used rather than support battens.

Replacement Concrete Floor



	Thickness (mm) of Specified Insulant Required to Achieve U–value Shown		
U–value (W/m²·K)	0.25	0.18	0.15
Kingspan **Kool**therm® K3 Floorboard	50	90	110
Kingspan OPTIM-R™ Flooring System*	25	35	50
EPS (0.032 W/m·K)	75	125	155
XPS (0.029 W/m·K)	70	125	140

Figures based on a P/A ratio of 0.5

* The bridging effect of the *Kingspan* OPTIM-R™ *flex* component of the system is taken as 15%. The build-up may be made up of two layers of insulation.

Why Kingspan Insulation?

- *Kingspan* **Kool**therm® offers the thinnest commonly used solution. *Kingspan* OPTIM-R™ **Roofing System** is the thinnest possible solution to insulation problems.
- Mineral fibre quilt is not rigid, and it is therefore difficult to ensure complete fill of the void between floor joists in suspended timber floors, without minute attention to detail in the installation of its support e.g. netting.
- Cold bridging and thermal performance reduction, caused by air–infiltration of mineral fibre from the necessary under–floor ventilation, may be an inevitable consequence in suspended timber floors.
- Greater thicknesses of floor insulation will necessitate the removal of a greater depth of material from under the existing floor, adding to the cost and time of installing a replacement concrete floor.

Refurbishment Case Studies

The case studies on the following pages show what can be achieved by refurbishing buildings. In some cases, measures such as double glazing, MVHR or solar thermal systems have been used, but the emphasis of these studies is to showcase the use of Kingspan Insulation products.

More information can be found via the links given at the end of each case study, which will refer you to the relevant architect, client, contractor, surveyor or specialist. That list is not exhaustive and for reasons of space we have only included a short selection of what is available.

Refurbishment Case Studies

Project Name: Morecambe

Building Type: Residential Low Rise
Location: Morecambe, Lancashire
Client: Private Client

Introduction

The retrofit formed part of a larger field study in England, undertaken by the Energy Saving Trust (EST), of 36 existing hard-to-treat dwellings, in order to quantify the energy-efficiency benefits that result from upgrading levels of solid wall insulation (SWI).

The dwelling is a pre-1900, stone-built, solid-walled, end-terrace with a total building floor area of 140 m^2 and double glazed windows throughout. It comprises two main floors, a small converted loft room and a basement beneath the lounge. The basement walls are not exposed to the outdoors. The ground level outside the property rises above that inside, from the front to the rear and is potentially a risk area for damp. The basement walls were not insulated as part of the project, nor were the roof, ceilings and floors. A gas condensing boiler provides primary space and water heating, whilst a solid fuel stove in the open-plan ground floor living space provides auxiliary space heating.

Insulation Solution Employed

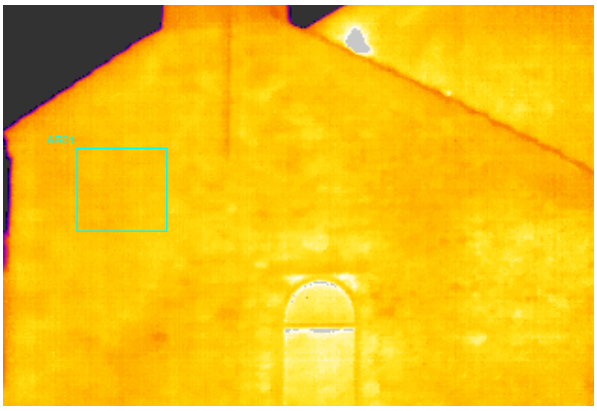
- Walls: U–value 0.22 W/m^2·K. 92.5 mm *Kingspan* **Kool**therm® K18 Insulated Plasterboard.

Challenges Faced

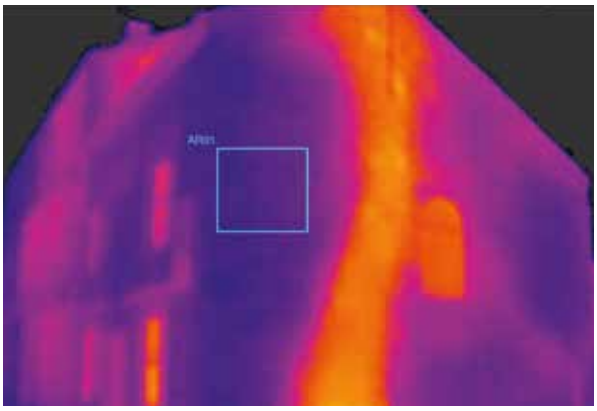
- The dwelling is situated in a conversation area. As such, planning permission for works to the exterior of the dwelling may have been less likely to have been granted.
- The homeowners, a young family of four, wished to remain in the property throughout the duration of the works. Precautionary measures were taken to minimise the impact of any disturbance, including the use of sheeting to protect soft furnishings, and execution of the works on a room by room basis. To enable living arrangements to continue as normally as possible, materials were temporarily stored outdoors, clear of the ground and protected from weather.
- At the time of the initial inspection, there was no evidence of damp. However, damp within the disused stone fireplace located in the kitchen was later identified during the pre-installation survey. Renovation works had to be carried out to remedy the problem prior to the installation.

What was Achieved

- The U-value of the wall improved by 83%.
- The normalised annual gas consumption for primary space heating decreased appreciably by 20%, thus corresponding CO_2 emissions and costs also decreased by the same margin.
- The Energy Efficiency (SAP) and Environmental Impact (EI) Ratings moved up a band, from D to C.
- The Dwelling Emission Rate (DER) improved by 32%.



Thermal Image of External Gable Wall before IWI (Outdoor Ambient Air Temperature =7.3°C & Wall Surface Temperature Defined in Area AR01 = 9.4°C).



Thermal Image of External Gable Wall after IWI (Outdoor Ambient Air Temperature = 0.0°C & Wall Surface temperature Defined in Area AR01 = 0.8°C.


DEANSGATE

Refurbishment Case Studies

Project Name: Burnley

Building Type: Residential Low Rise
Location: Burnley, Lancashire
Client: Private Client

Introduction

To assess what effect solid wall insulation (SWI) can have on actual building energy consumption and performance, the Energy Saving Trust (EST) undertook a major nationwide study evaluating the impact of upgrading the SWI on 36 hard-to-treat properties, the Burnley property being one.

The property is a pre-1900 stone-built, solid-walled, mid-terrace with a total building floor area of 138 m^2 and double glazed windows throughout, one of which being a front bay window with plaster cornice detailing. It comprises two main floors and a basement beneath the front part of the house with one wall exposed to the outdoors. A pre-1979 gas boiler provides primary space and water heating. The property is occupied by a retired couple in their mid-sixties. The roof, ceiling and floors were not insulated as part of the project.

Insulation Solution Employed

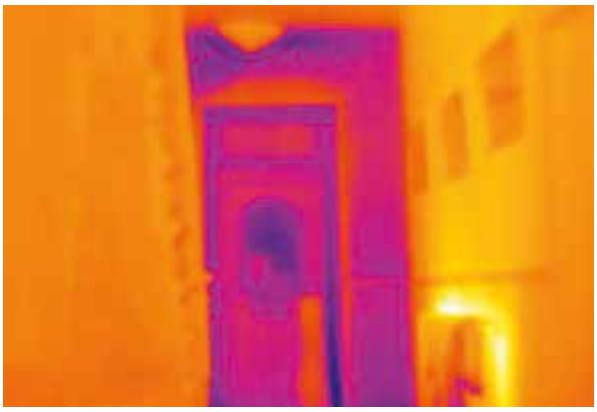
- Walls: U–value 0.22 $W/m^2 \cdot K$. 92.5 mm *Kingspan* **Kool**therm® K18 Insulated Plasterboard.

Challenges Faced

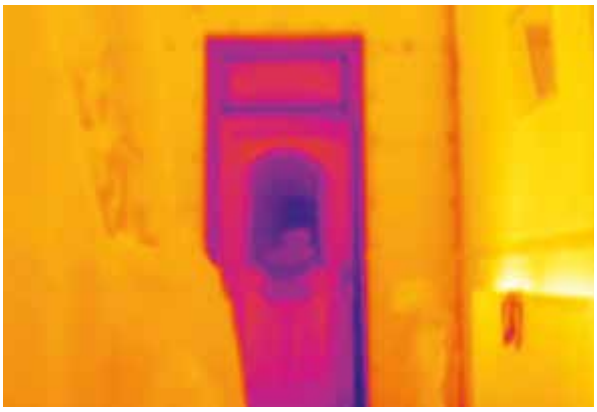
- The area in which the dwelling is situated was part of an ongoing renewal project involving property face-lifts. As a consequence, restrictions were placed on any alterations to the exterior including external wall insulation. Therefore, internal wall insulation was the only option.
- The owners wanted to preserve the existing plaster cornice detailing around the bay window. In order to accommodate the insulation, particular care was required when it was removed and subsequently replaced.

What was Achieved

- The U-value of the wall improved by 89%.
- The normalised annual gas consumption for primary space heating decreased by 45%, this corresponding CO_2 emissions and costs also decreased by the same margin.
- Air-tightness improved by 57%.
- The mean average indoor ambient temperature rose by 6%.
- The Energy Efficiency (SAP) and Environmental Impact (EI) Ratings moved up a band, from D to C.
- The Dwelling Emission Rate (DER) improved by 32%.



Thermal Image of External Gable Wall before IWI (Outdoor Ambient Air Temperature =7.3°C & Wall Surface Temperature Defined in Area AR01 = 9.4°C).



Thermal Image of External Gable Wall after IWI (Outdoor Ambient Air Temperature = 0.0°C & Wall Surface temperature Defined in Area AR01 = 0.8°C.

Refurbishment Case Studies

Project Name: 17, St Augustine's Road

Building Type: Residential Semi–Detached
Location: Camden, London
Client: London Borough of Camden

Introduction

The complete renovation of a dilapidated 6 bedroomed 1850's semi–detached solid–walled house in a conservation area. The property needed conversion from two separate flats back into a single home for local authority tenants. The building was in a very poor state of repair and needed total renovation of the building fabric in order to make it habitable. The aim was to reduce the carbon dioxide emissions caused by the property by approximately 80% whilst making the most use of the internal space.

Insulation Solution Employed

- Walls: U–value 0.19 W/m²·K. 102.5 mm *Kingspan* **Kool**therm® K18 Insulated Plasterboard on most solid brick walls.
- Pitched Roof: U–value 0.15 W/m²·K. Two layers of 75 mm *Kingspan* **Kool**therm® K7 Pitched Roof Board with nilvent breathable membrane in a between and over rafter construction.
- Floor: U–value 0.23 W/m²·K. The basement concrete slab was insulated with *Kingspan* **Kool**therm® K3 Floorboard with a new screed laid above.

Challenges Faced

- Conservation area – had to ensure that roof lines and heights weren't breached and that the external look of the property wasn't altered.
- Ensuring that all subsequent trades didn't 'undo' the work of previous trades, e.g. not puncturing an air–tight membrane.
- Controls for heating and plumbing need to be made simple for those trades and, more importantly, for the occupants of the building.

What was Achieved

- The fabric of the building was improved significantly, changing the energy rating from F to B.

Monitoring took place in the winter of 2008/2009:

Airtightness improved from 30 m³/hr/m² to 6.5 m³/hr/m²

55% to 70% reduction in gas consumption

CO_2 emissions reduced from 10,900 Kg/CO_2/yr to between 3,800 to 4,900 Kg/CO_2/Yr

More Information

You Tube: Search for 'Camden Low Energy Victorian House'.

Google: Search for 'Camden Low Energy Victorian House'.

Plywood installed over insulation was used to take the weight of heavy fixtures and fittings in the kitchen.

Kingspan **Kool**therm® K3 Floorboard, installed in the basement.

Refurbishment Case Studies

Project Name: Pantile Avenue

Building Type: Residential Low Rise
Location: Southend-on-Sea
Client: South Essex Homes

Introduction

The retrofit of ten under-insulated bungalows was funded as part of the £1.2 million ReallySmartHouse project, which was overseen by Southend-on-Sea Borough Council, South Essex Homes and architects, The Facility. They were tasked with improving the thermal performance within the minimal cavity space behind the facades. The ReallySmartHouse scheme has been jointly funded by Southend-on-Sea Borough Council and the European Regional Development Fund.

Insulation Solution Employed

- Walls: U–value 0.20 W/m²·K. 20 mm *Kingspan* OPTIM-R™ External Wall System.

Challenges Faced

- The project board wanted the exterior of the bungalows to look the same as they had before work commenced whilst also delivering a significant improvement in the thermal efficiency of the building envelope.
- The bungalows had to be occupied during the work and the tenants needed to be liaised with over the schedule.

What was Achieved

- The high levels of heat loss allowed through the u-PVC facades gave an external wall U-value of 1.19 W/m²·K. this was improved to 0.20 W/m²·K with 20 mm of the *Kingspan* OPTIM-R™ External Wall System.
- *Kingspan* OPTIM-R™ External Wall System allowed them to achieve the required U-value within the tight cavities without changing the exterior of the dwellings.

More Information

http://www.the-facility.co.uk/

http://reallysmarthouse.com

http://www.east-of-england.eu/news/southend-on-sea-selected-to-join-the-european-inno/

Ten under-insulated bungalows were funded as part of the £1.2 million ReallySmartHouse project.

Kingspan OPTIM-R™ External Wall System was installed behind the u-PVC facade.

Refurbishment Case Studies

Project Name:
100 Princedale Road Passivhaus

Building Type: Residential Low Rise, Social Housing
Location: London
Client: Octavia Housing

Introduction

A Victorian three–storey terraced house, in the Holland Park conservation area in London, became the UK's first Passivhaus certified domestic refurbishment.

Insulation Solution Employed

- Walls: U–value 0.10 W/m²·K. 150 mm *Kingspan* **Therma**wall® TW55 was installed on one side of an OSB air barrier and 50 mm of TW55 on the other.
- Ceiling: U–value 0.15 W/m²·K. 150 mm *Kingspan* **Therma**wall® TW55 was installed between the joists of the top floor ceiling, an OSB air barrier was fixed underneath the joists followed by 50 mm of TW55 finished with 12 mm plasterboard.
- Floor: U–value 0.14 W/m²·K. The floor over the cellar was formed by two layers of OSB with 150 mm *Kingspan* **Therma**floor® TF70 between them.

Protecting and maintaining the external appearance in the Conservation area was vital.

Challenges Faced

- Designing for social housing and tenants who may not be energy–conscious.
- The house was in a conservation area, so the preferred option of external wall insulation was not viable.
- To create air–tightness within a building over 150 years old.
- To ensure that internal space take–up by insulation measures was kept to a minimum.

What was Achieved

- An airtightness of 0.5 m³/hr/m² at 50 Pa was achieved.
- A predicted 83% reduction in carbon dioxide emissions and a 94% cut in energy use.
- The building's heating demand is estimated to be just 15 kW.h of energy per m² per year (the UK average is 130 kW.h per m² per year) – saving the tenants around £910 annually on fuel bills.
- The house requires no gas boiler, radiators or conventional heating system, yet remains at a comfortable temperature with a healthy flow of air all year round.

More Information

www.greenoctavia.org.uk/

www.pauldavisandpartners.com/projects/residential/retrofit/

All images on this page courtesy of Octavia Housing.

Refurbishment Case Studies

Project Name: 225 Court Farm Road

Building Type: Residential Low Rise
Location: Mottingham, London
Client: Hyde Housing Association with ECD Architects

Introduction

A 1930's two bedroom terraced house in South London underwent a full refurbishment, with the aim of reducing the carbon dioxide emissions caused by the property by 80%. The house was monitored to see which measures selected provide the most practical, cost effective and replicable solutions. The house was built with cavity walls which were filled with blown cavity wall insulation. To the rear of the property is a single storey extension containing a third bedroom with en suite bathroom.

Insulation Solution Employed

- Walls: U–value 0.18 W/m²·K. 82.5 mm *Kingspan* **Kool**therm® K17 Insulated Plasterboard on the external walls of original building.
- Walls: U–value 0.23 W/m²·K. 100 mm *Kingspan* **Kool**therm® K5 External Wall Board under a 10 mm polymer render on the rear extension.
- Roof: U–value 0.10 W/m²·K. A total of 170 mm *Kingspan* **Therma**floor® TF70 (made up of 2 layers) laid over existing floor joists at ceiling level in the original pitched roof with floating tongue and groove floorboards over. A breathable multi–foil insulation was used to line the existing rafters.
- Flat Roof: U–value 0.10 W/m²·K. 220 mm *Kingspan* **Therma**roof® TR27 LPC/FM was used on the flat roof of the extension.
- Floor: U–value 0.20 W/m²·K. 100 mm *Kingspan* **Kool**therm® K3 Floorboard between joists with *Kingspan* ***nilvent***® breathable membrane between the joists to act as an airtightness layer.

Challenges Faced

- Ensuring that the contractors were fully versed in the concept of airtightness.

What was Achieved

- Predicted space heating requirements are estimated to reduce from 17,238 kW.h/yr to 2,410 kW.h/yr – a drop of over 86%.

More Information

www.hyde-housing.co.uk/client_files/aboutus/RetrofitandReplicateProject.pdf

www.ecda.co.uk/download/257

Using Kooltherm insulation can help ensure the maximum use of internal space.

Detailing was particularly important around window reveals and access to services.

All images on this page courtesy of The Hyde Group.

Refurbishment Case Studies

Project Name: Lena Gardens Passivhaus

Building Type: Private Residential Low Rise
Location: Hammersmith, London
Client: Princedale Ecohaus Ltd and Green Tomato Energy

Introduction

Lena Gardens is a solid–walled Victorian mid–terrace built in the 1870's. Now in a conservation area in Hammersmith, the exterior of the house had to remain unchanged, meaning that all insulation measures were applied internally. The retrofit was also designed to achieve the rigorous Passivhaus EnerPHit standard.

Insulation Solution Employed

- Roof: U–value 0.14 W/m²·K. 130 mm *Kingspan* **Kool**therm® K7 Pitched Roof Board was fitted between the rafters followed by a layer of OSB sealed for airtightness and then a further 50 mm layer of *Kingspan* **Kool**therm® K7 Pitched Roof Board.
- External Walls: U–value 0.10 W/m²·K. 130 mm *Kingspan* **Kool**therm® K12 Framing Board was installed followed by the air–tight OSB layer and a further 50 mm of *Kingspan* **Kool**therm® K12 Framing Board.
- Party Walls: U–value 0.27 W/m²·K. 50 mm *Kingspan* **Kool**therm® K12 Framing Board was installed along with the continuous OSB layer.
- Floors: U–value 0.11 W/m²·K. 200 mm *Kingspan* **Therma**floor® TF70 was used to insulate the suspended timber ground floors with 150 mm of the same installed below a new concrete slab in the kitchen.

Challenges Faced

- Complex geometry and a rear kitchen extension.
- Floors needed to be re-hung in order to reduce thermal bridges required by the Passivhaus standard.
- The building is in a Conservation area, so no change of external appearance was permitted.

What was Achieved

- Measured air tightness of 0.49 ACH @ 50 Pa which is even less than the 0.6 required by the Passivhaus standard.
- Measured electricity consumption of just 12.8 kWh/m²/yr – the same as predicted in the PHPP model.

More Information

www.greentomatoenergy.com/docs/lenagardens_casestudy.pdf

http://retrofitforthefuture.org/projectPDF.php?id=254

http://ecohome.tumblr.com/post/18075343576/a-years data-da-dah

Detail showing the wall construction with the OSB airtightness layer and steel used to re–hang the floors.

Careful taping and sealing of joints with *Kingspan* **Kool**therm® K7 Pitched Roof Board.

Refurbishment Case Studies

Project Name: The Nook

Building Type: Social Housing Low Rise
Location: Brighton, Brighton & Hove
Client: Two Piers Housing Cooperative

Introduction

The refurbishment of a 6 bedroom solid walled Victorian detached property, used for social housing and owned by Two Piers Housing Cooperative. £150,000 funding was received from the Technology Strategy Board as part of the Retrofit for the Future competition. Whole house package of measures was created by architects BBM Sustainable Design with the building work carried out by Earthwise Construction.

Insulation Solution Employed

- Roof: U–value 0.10 W/m²·K. 100 mm *Kingspan* **Kool**therm® K7 Pitched Roof Board between joists with another layer over the joists.
- Walls: U–value 0.15 W/m²·K. A hybrid approach was used – 120 mm *Kingspan* **Kool**therm® K12 Framing Board was installed internally on the front elevation and 120 mm *Kingspan* **Kool**therm® K5 External Wall Board was used on the side and rear elevations.
- Ground floor: U–value 0.13 W/m²·K. 100 mm *Kingspan* **Kool**therm® K3 Floorboard was used over the existing floor slab with a new floating wooden floor over the top.
- Other measures: improved glazing, a condensing gas boiler, a solar thermal array and MVHR.
- Air leakage: a continuous air barrier comprising a combination of cement render and Pro Clima Intello Plus membrane was used on all external elements to reduce drafts and air leakage.

Challenges Faced

- The house is in a conservation area, so conditions were in place regarding the appearance of the front elevation.

What was Achieved

- The property had an initial SAP rating of 33 and energy rating 'F' before refurbishment, with a SAP rating of 82 and an energy rating 'B' when finished.
- Carbon dioxide emissions caused by the property were predicted to fall by 80%.
- Energy bills were predicted to reduce from £1,450 per year to under £750.

The energy requirement was forecast to reduce from 577 kWh/m²/yr to 114 kWh/m²/yr.

More Information

http://2010.ecoopenhouses.org/media/Case%20study%20overs%20Walk.pdf

http://www.bbm-architects.co.uk

www.retrofitforthefuture.org

Kingspan **Kool**therm® K18 Insulated Plasterboard used in the hallway encroached as little as possible on available space.

Internal wall insulation used in the front room on the front elevation.

Refurbishment Case Studies

Project Name: Falmouth Farm

Building Type: Private Housing Low Rise
Location: Cornwall
Client: Private Client

Introduction

The terrace of this idyllic former farmhouse, which is situated in the rural outskirts of Falmouth, makes up part of a much larger extension to the property. The original ground floor kitchen had been extended and a utility room created, whilst upstairs a large dayroom now opens out onto the spacious terrace. The work, overseen by main contractors AMJ Renovations, is sympathetic to the original farmhouse using a range of traditional materials such as stone and lime render.

Insulation Solution Employed

Balcony and Terrace (roof): U–value 0.16 W/m²·K 40 mm *Kingspan* OPTIM-R™ **Balcony and Terrace System**.

Challenges faced

- The client needed to ensure a seamless transition from the dayroom out onto the terrace without having to adjust the ceiling height in the kitchen below, whilst also achieving a compliant U-value.

What was achieved

- The thickness of conventional insulation needed to achieve the required U-value would have required the terrace to be raised higher than the floor level in the internal rooms, creating an awkward step. However, using *Kingspan* OPTIM-R™ **Balcony and Terrace System** an even transition between the day room and terrace was maintained.
- Clear layouts and designs were provided by Kingspan's specialist technical team, ensuring that the required U-value was achieved with minimal thickness and maximum coverage of *Kingspan* OPTIM-R™ panels.

Falmouth Farm is a traditional rural farmhouse extended and modernised.

Kingspan OPTIM-R™ **Balcony & Terrace System** installed on the new terrace.

Contact Details

Customer Service

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

UK – Tel: +44 (0) 1544 388 601
– Fax: +44 (0) 1544 388 888
– email: customerservice@kingspaninsulation.co.uk

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, or visit the Kingspan Insulation website, using the details below:

UK – Tel: +44 (0) 1544 387 384
– Fax: +44 (0) 1544 387 484
– email: literature@kingspaninsulation.co.uk
– www.kingspaninsulation.co.uk/literature

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 – Tel: +44 (0) 1544 387 383
– Fax: +44 (0) 1544 387 483
– email: tapered@kingspaninsulation.co.uk

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.

The Kingspan Insulation British Technical Service Department operates under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U–value and Condensation Risk Calculations.

BBA CERTIFICATE CS/1004-2 U Value Competency Scheme

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

UK – Tel: +44 (0) 1544 387 382
– Fax: +44 (0) 1544 387 482
– email: technical@kingspaninsulation.co.uk

General Enquiries

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

UK – Tel: +44 (0) 1544 388 601
– Fax: +44 (0) 1544 388 888
– email: info@kingspaninsulation.co.uk

Kingspan Insulation Ltd. reserves the right to amend product specifications without prior notice. Product thicknesses shown in this document should not be taken as being available ex–stock and reference should be made to the current Kingspan Insulation price–list or advice sought from Kingspan Insulation's Customer Service Department (see above left). 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 for suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation offers a Technical Advisory Service (see above), the advice of which should be sought for uses of Kingspan Insulation products that are not specifically described herein. Please check that your copy of this literature is current by contacting the Kingspan Insulation Marketing Department (see left).

Kingspan Insulation Ltd is a member of:
The National Insulation Association (NIA)

Kingspan®

Kingspan Insulation Ltd
Pembridge, Leominster, Herefordshire HR6 9LA, UK
www.kingspaninsulation.co.uk