Presentation Contents

- Why do we need to insulate?
- Building Regulations – Revised Part L – Now Implemented
- Physical properties & benefits of Kingspan Insulation products & Rigid Insulation Boards
- Insulation problems and solutions
Why Do We Need To Insulate?
Why Do We Need To Insulate?

- To counteract global warming by reducing CO$_2$ emissions (Compliance With Kyoto)
- Compliance with Building Regulations (Revised Part L)
- To reduce fuel bills & Associated Running Costs
- To prevent condensation (The Often Unseen Enemy)
Building Regulations / Standards

20% reduction in CO₂ emissions
Counteract Global Warming by Reducing CO$_2$ Emissions

Up to 55% of Ireland’s CO$_2$ emissions are produced from energy used in heating buildings & The burning of fossil fuels such as Coal, Oil & Gas.
Kyoto Climate Summit

• Described as a Green house gas reduction Protocol
• All affiliated nations bound to reduce CO₂ emissions (Ireland is an affiliated nation)
• 55% of current CO₂ emissions are attributed to dwellings & commercial buildings
• E.U. Proposes a 15% reduction from 1990 emissions by 2010
• Ireland are already 20% behind their Kyoto targets
• By now, we are all aware of the soon to be introduced carbon taxes.
Harmonised European Standards
90% of all materials delivered to market will have a thermal performance better than the stated value

All Insulants
Lambda
90:90

March 2003
Timescale For Changes

Rigid Extruded Polystyrene
Zero ODP
Jan 1 2002

PUR
Zero ODP
Jan 1 2003

PIR & Phenolic
Zero ODP
Jan 1 2004
Blowing Agent Phase Out Timescale

Styrozone already is Zero ODP

Rigid Extruded Polystyrene Zero ODP

Kooltherm available Zero ODP

Therma as standard Zero ODP

PUR Zero ODP

PIR & Phenolic Zero ODP

Jan 1 2002 April 1 2002 Jan 1 2003 Jan 1 2004
Introduction Of Harmonised European Standards

- **Therma**
  - Lambda 90:90

- **Styrozone**
  - Lambda 90:90

- **All Insulants**
  - Lambda 90:90

- **Dates**
  - April 1, 2002
  - March 2003
Building Regulations / Standards
The changes can be summarised as follows:

◆ increased insulation standards
◆ greater heating system efficiencies
◆ reduced cold bridging
◆ increased air tightness
Some of the recommendations set out in TGD Part L 2002 are........

(A) “Occupants can achieve adequate levels of thermal comfort while minimising the use of scarce resources

(B) For “U” - Value” calculations, “Thermal Bridging” must be taken into account

(C) Buildings must be designed & constructed to show compliance with current Building Regulations
Approved Technical Guidance
Document L 2002-Impacts

• Focus on alternative means of insulating buildings
• The more widely accepted use of high performance insulation
• Warm roof construction as an option to traditional joist level insulation
• Wider cavity where 40mm residual cavity and partial fill insulation is to be used
• Insulated plasterboard as an option to cavity insulation
• More attention to building detail, design, workmanship and installation to prevent problems associated with insulating ie. Condensation
Approved Technical Guidance
Document L 2002 - Benefits of Compliance

- Positive step to address problem of CO₂ emissions
- Compliance with Kyoto Protocol policies & measures
- Conservation of fossil fuel use - increased sustainability
- Reduction in cost of heating our homes (Often Overlooked)
- Reduction in harmful CO₂ emissions
- Future review of heat loss may result in retrofitting insulation
- The use of high performance insulation will help future proof your home
### Part L, Recent Changes – Dwellings – Some Of The Lowest In Europe

<table>
<thead>
<tr>
<th>Construction Element</th>
<th>Pre 2002 U-value Requirement</th>
<th>Current U-value Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>0.45 W/m²K</td>
<td>0.27 W/m²K</td>
</tr>
<tr>
<td>Floors</td>
<td>0.45 W/m²K</td>
<td>0.25 W/m²K</td>
</tr>
<tr>
<td>Roofs</td>
<td>0.25 W/m²K</td>
<td>0.16 W/m²K</td>
</tr>
<tr>
<td>Windows</td>
<td>3.3 W/m²K</td>
<td>2.0 W/m²K</td>
</tr>
</tbody>
</table>
3 Main Methods Of Compliance With Revised Part L - Dwellings

- Elemental Heat Loss Method
- Overall Heat Loss Method
- Heat Energy Rating Method
What Is A ‘U’ - Value

• All materials have a thermal conductivity (Lambda value)

• This is a measure of the rate at which it allows heat to pass through it (W/mK)

• ‘U’ - Value is the inverse of the sum of the resistance

\[
1/R = 'U' - Value
\]

• Thermal Resistance (U-Value) is a material's ability to resist the passage of heat

• Lambda of polyurethane is 0.019 W/mK

• Therefore Thermal resistance of 50mm PU = 0.05/0.019 = 2.63

• By increasing insulant thickness the resistance is greater and therefore the ‘U’ - Value is lower
All elements of construction offer resistance

\[
\frac{1}{r + r + r + r + r} = \frac{1}{R} = \text{“U” Value}
\]
Where The Heat Goes

Before Insulation

25% Air tightness / Doors
35% Floors

After Insulation

8% Air tightness / Doors
10-12% Floors

15% Windows
10% 5%
9% 9%

100% fuel usage 42% fuel usage
Condensation Risks
( The Often Unseen Enemy)
Surface Condensation
Condensation occurring on visible surfaces within the building

Warm moist air

Cool Surface

Outside cold air

Warm moist air condenses
Interstitial Condensation

Condensation occurring within or between the layers of the building envelope

Warm moist air

Condenses as structure becomes cool

Outside cold air

Low vapour pressure
Condensation occurs when any moisture laden air comes in contact with a surface below dew point temp.

This can happen when it comes in contact with a cold surface.

When warm moist air is drawn into the building fabric, "Interstitial" condensation can occur.

The main risk involved with interstitial condensation is that it can go undetected & is very expensive to rectify.

Kingspan Insulation products are closed cell and will not readily accept moisture.

Because of their thermal efficiency, they help eliminate interstitial condensation.

They also have a Triplex foil facing which automatically behaves as a vapour barrier.
Condensation predicted within the wall structure
No condensation predicted within the wall structure
(does not take into account facings)
Kingspan Insulation product’s offer high vapour resistivity:

- reduces vapour transmission through structure because of foil facings
- offers inherent resistance to interstitial condensation
- Triplex foil facings offer in built vapour check
Product Issues
Thermal Conductivity

- Phenolic Insulation
- Rigid Urethane Insulation Zero ODP
- Extruded Polystyrene Insulation Zero ODP
- Expanded Polystyrene
- Rock Mineral Fibre
- Glass Mineral Fibre
- Cork

Values:
- Phenolic Insulation: 0.018 W/m.K
- Rigid Urethane Insulation Zero ODP: 0.022 W/m.K
- Extruded Polystyrene Insulation Zero ODP: 0.028 W/m.K
- Expanded Polystyrene: 0.034 W/m.K
- Rock Mineral Fibre: 0.036 W/m.K
- Glass Mineral Fibre: 0.040 W/m.K
- Cork: 0.042 W/m.K
Thickness Comparison
Thicknesses to achieve an R value of 5 m².K/W
Compressive Strength

- Phenolic Insulation: 175 kN/m²
- Rigid Urethane Insulation: 150 kN/m²
- Extruded Polystyrene Insulation: 400 kN/m²
- Expanded Polystyrene Insulation: 110 kN/m²
- Rock Mineral Fibre: 100 kN/m²
- Glass Mineral Fibre: 10 kN/m²
Kingspan Insulation Products
High Compressive Strength

Kingspan Products can withstand 3.5 per m² tonnes of distributed dead-weight load; more than enough for:

- limited foot traffic
- ballast
- paving slabs
- limited impact resistance (Not Point Loads)
Fire Performance
PIR/PUR foams do not readily ignite when in contact with flame.

In most applications the foam is covered with facing materials.

Highest risk for contact with flame is during storage or installation.

They do not ignite spontaneously.

If fully ignited, they do not drip flaming droplets.

PIR products are described as self extinguishing.

Composite structures containing PUR/PIR are approved by Factory Mutual & loss prevention council.
European Fire Classifications Will Replace The Current BS 476 Standards

- reaction to fire for exposed wall and ceiling construction elements

- resistance to fire

- reaction to fire for non-exposed wall elements, and all roof and flooring products
New EU Fire Classification

Rigid Phenolic Insulation
e.g. Kingspan Kooltherm K10

Plasterboard Faced Products
e.g. Kingspan Thermawall TW52 zero ODP
Kingspan Thermawall TW56 zero ODP
European Fire Classifications

- legislative requirements will vary by application
- Class O and 1 products will not be discriminated against
- simple conversion tables should be avoided
<table>
<thead>
<tr>
<th>Material</th>
<th>&quot;K&quot; Value</th>
<th>Properties</th>
<th>Service Temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIR Polyisocyanurate Rigid</td>
<td>0.019 W/mK</td>
<td>Thermal &amp; Physical properties similar to PUR</td>
<td>Can operate in higher service temperatures</td>
</tr>
<tr>
<td>PUR Polyurethane Rigid</td>
<td>0.019 W/mK</td>
<td>Thermal &amp; Physical properties similar to PIR</td>
<td>Better fire performance</td>
</tr>
</tbody>
</table>
Smoke

BS 5111 Part 1: 1974 smoke obscuration test results

- phenolic insulation $< 5\%$
- mineral fibre $< 5\%$
Phenolic insulation products can offer fire performance and smoke emission comparable with mineral fibre.

Performance tests to consider:

- BS 5111 : Part 1 : 1974
- NES 713
Toxic Gas Emissions
Naval Engineering Standard 713: products of combustion test results

- phenolic insulation: pass
- mineral fibre: pass
Pitched Roof Construction - Problems
Cold Roof

- Partially insulated leaving ventilated spaces
- Fully insulated - no ventilation

Warm Roof

- Ventilation
- Cold loft - not advisable for storage

- No Ventilation
- Warm storage

Partially insulated leaving ventilated spaces

Fully insulated - no ventilation
Roof Problems 1

- gaps between mineral fibre and joists;
- missing or poorly placed mineral fibre;
- permanent compression of the mineral fibre from poor handling and being squeezed into constricted spaces;
- mineral fibre compressed by articles left in the attic by the installation team or storage of household items
- accumulation of dust, permanent thinning and loss of structural qualities
Roof Problems 2

Overfilling of the eaves causes blocked ventilation paths which can result in:

- condensation occurring on the underside of the felt;
- moisture staining or mould growth on rafters;
- moisture content can be above the critical level for dry rot;
- condensation and rafter wetting likely to continue throughout winter;
- potential for rafter degradation extremely high.
Pitched Roof
The Solutions
Pitched Warm Roof Insulation

- the most technically advanced solution
- achieves U-values with minimum thickness
- 80mm +25mm TW52 can achieve 0.20 W/m²K
- no condensation risk
- resistant to passage of water vapour
- reliable performance during lifetime of the building
- safe and easy to install
Pitched Roof Insulation

Over rafter sarking insulation beneath tiled or slated pitched warm roofs

Breathable sarking membrane
Rafters
Unvented cavity
Tiles / slates
Tile / slate batten
Counter-batten
Plasterboard

Kingspan Thermapitch TP10 or Kooltherm® K7 Sarking Board over rafters

SINGLE LAYER INSULATION
Room In The Roof – Attic Conversion

Benefits to the Home Owner-Newbuild
- Additional space at relatively low cost
- Added value - Irish estate agents estimate that converting a loft space to a living space can add €30-35,000 to the value of a typical family home

Benefits to the House Builder-Refurbishment
- Increased yield of square footage per acre
- Increased profitability
- Allows greater scope for creative designs
- Unique selling point
Kooltherm K7 and Thermapitch TP10 zero ODP
Wall Insulation - Problems

- Full fill cavity insulation promotes the passage of moisture across the cavity
- Where partial fill is used, a 40mm residual cavity must be incorporated - Building Regulations
- Poor workmanship with full fill cavity insulation can lead to mortar droppings bridging the cavity
- Mineral fibre can become weathered before the cavity is closed which reduces thermal performance
Wall Insulation Solutions
Wall Insulation Kingspan TW50

- the most technically advanced solution
- achieves U-values with minimum thickness
- reliable performance during lifetime of the building
- offers inherent resistance to wind driven rain penetration - suitable for ALL exposure zones
- safe and easy to install
- unaffected by air movement

Thermographic image of building with Kingspan Insulation showing 100% reliable thermal performance
Cavity Wall Insulation

Kingspan Therma
or Kooltherm®
K8 Cavity Board

Irish Agrément Certificate for TW50 & TW52
Internal Dry Lining

Kingspan
Therma\textit{wall}
TW52

Multipurpose adhesive dabs

Nailable plugs
(3 No. per board)

Brick / block inner and outer leaf

Continuous fillet of adhesive acting as fire stop

In built vapour check
External Wall Insulation

- Glass fibre scrim
- Bedding adhesive
- Mechanical fixings
- Kooltherm®
  - K5 EWB
- Adhesive
- Existing masonry wall
- External render
Kooltherm K12 and Thermawall TW55 zero ODP
Other Typical Wall Constructions

- Kingspan Thermawall TW52 zero ODP
- & Kingspan Thermawall TW56 zero ODP

- Kingspan Kooltherm K5 EWB
- & Kingspan Thermawall TW53 zero ODP

- Kingspan Kooltherm K15 Rainscreen Board
Wall Insulation

Thermographic image contrasting the terrace insulated with injected full fill fibre cavity wall insulation on the left with the terrace on the right insulated externally with Kingspan Insulation products.
Floor Insulation Problems

• Non rigid insulants are unsuitable for floor applications due to low compressive strengths

• Some rigid insulants are not suitable to withstand compressive loading resulting in screed cracking

• Excessive insulation thickness due to low Thermal Performance reduces the “solid feel” to floors

• Insufficient insulation used with an underfloor heating system can greatly reduce its performance
Floor Insulation Solutions
Flooring ( Warm Floor Construction )
## Flooring

<table>
<thead>
<tr>
<th>Thicknesses (mm) to Achieve a U-value of 0.25 W/m².K</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid phenolic insulation (0.018 W/m.K)</td>
<td>50</td>
</tr>
<tr>
<td>Rigid urethane insulation (0.022 W/m.K)</td>
<td>60</td>
</tr>
<tr>
<td>XPS (0.028 W/m.K)</td>
<td>75</td>
</tr>
<tr>
<td>Glass mineral fibre (0.031 W/m.K)</td>
<td>85</td>
</tr>
<tr>
<td>EPS (0.037 W/m.K)</td>
<td>100</td>
</tr>
<tr>
<td>Rock mineral fibre (0.038 W/m.K)</td>
<td>105</td>
</tr>
</tbody>
</table>

Assumes a 7 x 7 m solid concrete or beam and dense block floor. Area is 49 m². Perimeter is 28 m. P/A is 0.57
Kooltherm K3, Thermafloor TF70 zero ODP, and Styrozone XPS, zero ODP
Thermafloor TF73 zero ODP Ply Backed XPS Insulation Boards
Flooring

Kingspan Kooltherm K10 Soffit Board

Kingspan Kooltherm K10 Plus Protected Soffit Board
Insulation for solid concrete and suspended ground floors
(Under the Sub-floor or Under the screed)

Kingspan Therma
floor TF70
or Kooltherm® K3 Floorboard

Concrete slab

Floor screed

Hard core

Perimeter insulation

Separation layer

Kingspan ThermaWall
TW50/TW51
or Kooltherm® K8 Cavity Board

Damp proof membrane
Prefabricated Sustainable Building Systems
Incorporating SIP Technology
What is a SIP Technology?  
**Structural Insulated Panel**

15 mm OSB3
- Air tight jointing system

110 mm PIR CFC, HCFC free rigid foam

Autohesively bonded

15 mm OSB3
Specific Benefits to Builders / Developers

- Improved build speed.
- Reduced Capital & financing costs.
- Room in the Roof Construction.
  - (Increased habitable space using same land area)
- Reduced defects on-site = reduced warranty claims.
- Reduced reliance on wet trades.
- Exceeds proposed Building Regs. [Part L, 2002].
- Increased dimensional accuracy.
Compliance with Regulations

standard 0.22 W/m$^2$.K

easily 0.12 W/m$^2$.K

air tightness 1m$^3$/m$^3$/hour
Sustainability Issues

- Ozone Depletion
- Global Warming
- Resource Depletion
- Toxic Pollution
Egan Compliant

- a TEK Haus can be erected in 3 days
- quicker access to follow on trades
- predictable completion times
- reduced defects
- higher productivity
TEK Haus Financial Implications

- enhanced cash flow
- lower working capital
- greater turnover per hectare
- greater profit per hectare
- cost comparable with timber frame
The Benefits of Kingspan Insulation Products

- amongst the most thermally efficient insulation products commonly available
- achieve required U-values with the minimum thickness of insulant
- can offer fire performance and smoke emission comparable with mineral fibre
- provide reliable long term thermal performance over the lifetime of the building
- resist both moisture and water vapour ingress
Technical Support

- **TECHLINE**
  - U-value calculations
  - condensation risk analysis
  - wind uplift calculations
  - supported by detailed reports
- specification advice
- CAD assisted design service
- site surveys
- CPD Presentations
- CD Rom & Technical Literature

42 9795032

www.insulation.kingspan.com
Manufacturing and Product Dependability

Manufacturing to the highest quality standards

I.S. EN ISO 9002 : 1994
Registration No. M449

DIN EN ISO 9001 : 1987
Certificate No. 3290-04

BS EN ISO 9002 : 1994
Certificate No. FM 10697

FM APPROVED

IRISH AGRÉMENT BOARD

DQP

WIMLAS

KOMO

BBA BRITISH BOARD OF AGRÉMENT

BSI REGISTERED FIRM

LPCB