



One Size Fits All

A GUIDE TO BUILDING REGULATIONS / STANDARDS COMPLIANCE
FOR NEW DWELLINGS USING STRUCTURAL INSULATED PANELS (SIPS)



*Low Energy –
Low Carbon Buildings*

Contents

	Page
Introduction	4
Compliance with the Building Standards	5
Demonstrating Compliance	5
Linear Thermal Bridging	5
Air-Permeability Testing	6
Evidence of Compliance	6
Compliance with Approved Document L1A - New Dwellings (England)	7
Setting the Targets	7
Limiting Fabric Standards	9
Limits for Air-Permeability & Fixed Building Services	9
Compliance with Approved Document L1A - New Dwellings (Wales)	10
Setting the Targets	10
Limiting Fabric Standards	11
Limits for Air-Permeability & Fixed Building Services	11
Compliance with Approved Document L1A - New Dwellings (Scotland)	12
Setting the Targets	12
Limiting Fabric Standards	14
Limits for Air-Permeability & Fixed Building Services	14
Simplifying the Complex	15
Solutions for Compliance	16

Introduction

The various constituent countries of Great Britain now have differing requirements for domestic new build compliance.

- Approved Document L1A (ADL1A), published by The Department for Communities & Local Government (DCLG), for England, and by Welsh Government (Llwodraeth Cymru), for Wales, each give technical guidance on how to meet the energy efficiency requirements of the Building Regulations 2010, as amended for their respective countries.
- Technical Handbooks, published by the Scottish Government's Building Standards Division (BSD), give technical guidance on how to meet the energy efficiency requirements of Section 6, as amended, for building work carried out in Scotland. This document will focus on the revised version of Section 6 taking effect from 1 October 2015.

Kingspan Insulation have produced this document to demonstrate how compliance can be achieved for a new build dwelling, using the *Kingspan TEK® Building System* of structural insulated panels (SIPs), in any of the regions of Great Britain and, for the purpose of comparison, have included thermally equivalent solutions using other common insulation materials.

For guidance relating to new or existing non-domestic buildings, the non-domestic parts of mixed use developments, or for existing dwellings, further guidance is available at www.kingspaninsulation.co.uk/buildingregulations.

This guide focuses purely on dwellings, which can be defined as 'self-contained units designed to accommodate a single household'.

Compliance with the Building Standards

Demonstrating Compliance

The guidance documents for England, Scotland and Wales, set criteria that can be met to satisfy the energy efficiency requirements of the Building Regulations. These criteria comprise a mix of mandatory requirements and statutory guidance.

Those that relate to the building fabric, including insulation, for all three countries, are outlined below.

First and foremost, there is a need to show that the designed carbon dioxide emission rate for a dwelling (referred to as the 'Dwelling CO₂ Emission Rate' and expressed as 'DER'), does not exceed a defined maximum allowable emission rate (referred to as the 'Target CO₂ Emission Rate' and expressed as 'TER').

TER and DER calculations must be carried out by an accredited energy assessor in accordance with the National Calculation Methodology (NCM) i.e. the 2012 edition of the Standard Assessment Procedure (SAP 2012). A 'notional dwelling' concurrent specification, is used to determine the TER, with the notional dwelling specification differing by country.

The TER and DER are expressed as the mass of CO₂ in kilograms per square metre of floor area per annum (kg/m²/yr). TER and DER calculations take account of the CO₂ emission rate from space heating, hot water, ventilation and internal fixed lighting requirements using standardised assumptions for household occupancy set by the NCM. Also considered in the calculations are the thermal mass of the dwelling and minor heat gains from different sources, e.g. the sun, the occupants, household appliances and artificial lighting.

Secondly, individual building fabric elements and fixed building services must meet or exceed specified energy efficiency backstop standards.

Thirdly, there is a need to show that the quality of construction is such that the energy performance of the dwelling 'as built' matches or exceeds that 'as designed'.

Additional requirements and differing levels of backstops have been set for England, for Scotland and for Wales and these are addressed in more detail in the relevant specific sections of this guidance.

Two additional common areas of consideration are those of thermal bridging and air permeability.

Linear Thermal Bridging

The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps within the various elements; at the joints between elements; and at the edges of elements such as those around windows and door openings.

Compliance with the Building Standards

Air Permeability Testing

For each separate development, air-pressure testing will typically be required, although for developments of no more than two dwellings the developer can either: demonstrate that during the preceding twelve month period, a dwelling of the same dwelling type has achieved the designed air-permeability; or avoid the need to pressure test by using an air-permeability value of $15 \text{ m}^3/\text{hr}/\text{m}^2$ at 50 Pa when calculating the DER (this however makes it significantly more difficult for a dwelling to comply).

For developments subject to air-pressure testing, the specific criteria differs slightly between England, Scotland and Wales as regards sampling levels and the appropriate guidance should be consulted to determine specific regional differences.

Overall however, compliance with the requirements would be demonstrated if:

- the measured air-permeability is no worse than the applicable limiting value of $10 \text{ m}^3/\text{hr}/\text{m}^2$ at 50 Pa (albeit with no firm limit set for Scotland); and
- the DER calculated using the measured air-permeability is no worse than the TER.

If satisfactory performance is not achieved, then remedial measures should be carried out on the dwelling and additional tests carried out until the criteria set out above are achieved. Additional testing may also be required of other dwellings.

Evidence of Compliance

Much of the evidence for demonstrating compliance can comprise the results of SAP calculations.

On submitting a building regulations application, a carbon compliance calculation, commonly referred to as a 'design stage SAP', is required. The edition and version of the assessment current when the application is made is then set for the duration of the project for compliance purposes. So if a dwelling was assessed at design stage under SAP 2012, then compliance at the as-built stage would be to the same edition and version.

At the post-construction ('as built') stage, the Energy Performance Certificate (EPC) should be produced by an accredited assessor, using approved software which implements the current edition and version of the calculation methodology (SAP). This ensures that building owners are presented with the most current and relevant information practicable.

Both the 'designed' and 'as built' submissions include TER / DER calculations as well as a list of specifications, which demonstrate how compliance has been achieved.

NB The 'as built' submission used to produce the EPC must also include the assessed air-permeability of the dwelling and any changes to the 'designed' specifications.

The two submissions can be compared and used by Building Control to assist in checking whether what has been built matches or betters what was designed.

Compliance with Approved Document L1A - New Dwellings (England)

The 2013 edition of ADL1A came into effect on 6th April 2014. The guidance given is applicable to building work originating from plans and notices submitted to a building control body (BCB) for approval on or after this date.

Setting the targets

For the English Approved Document Part L1A (2013), a 'whole building' approach to minimising CO₂ emissions and fabric energy efficiency has been adopted, with a requirement that a new dwelling must be designed and built such that:

- its DER is no worse than its TER; and
- its DFEE is no worse than its TFEE.

The additional element for compliance purposes is the introduction of a Fabric Energy Efficiency metric.

The Target Fabric Energy Efficiency (referred to as 'TFEE') and the Dwelling Fabric Energy Efficiency, (referred to as 'DFEE'), are expressed as the amount of energy consumed in units of kilowatt hours per square metre of floor area per annum (kWh/m²/yr). The TFEE and DFEE calculations take account of energy losses through:

- the different elements of the dwelling's fabric i.e. roofs, walls, floors, doors and windows;
- thermal bridges at junctions, e.g. where a wall meets a floor, and around openings in the external element, e.g. the edges of a window; and
- air movement from leakage and ventilation.

Also considered in the calculations are the thermal mass of the dwelling and minor heat gains from different sources, e.g. the sun, the occupants, household appliances and artificial lighting.

A 'notional dwelling' of the same size and shape as the 'actual dwelling', built to a concurrent specification, is used to determine both the TER and the TFEE. The ADL1A 2013 notional dwelling specification is summarised in Section 5 of ADL1A and detailed in Appendix R of SAP 2012. The main elements of the concurrent specification of the notional dwelling that relate to the opaque building fabric are shown in Table 1. Whilst the concurrent specification helps to set the targets, the actual specification can and will differ from this.

Compliance with Approved Document L1A - New Dwellings (England)

Element	Value
All Roofs	0.13 W/m ² -K
Walls	0.18 W/m ² -K
Floors	0.13 W/m ² -K
Party Walls	0.00 W/m ² -K
Windows, Roof Windows, Glazed Rooflights & Glazed Doors	1.40 W/m ² -K / g-value 0.63
Opaque Doors	1.00 W/m ² -K
Semi Glazed Doors	1.20 W/m ² -K
Air-tightness	5.00 m ³ /hr/m ² at 50 Pa
Linear Thermal Transmittance	Standardised ψ -values (see Appendix R of SAP 2012)
Thermal Mass	Medium

Table 1: Selected Reference Values from the ADL1A 2013 Notional Dwelling Specification

NB The thermal transmittance values in the ADL1A 2013 notional dwelling specification are much more stringent than the thermal transmittances defined in the 2007 edition of Accredited Construction Details (ACDs). As a consequence, the designer would have to compensate for those poorer performing junctions elsewhere in the fabric if the latter were adopted.

For differing main heating fuels the target is adjusted based on a fuel factor set for the main heating fuel to be used. This allows targets to vary for different fuel types and this approach is common to England and Wales. The CO₂ emission rate from the proposed space heating and hot water (CH), pumps and fans (CPF) and internal lighting (CL) are calculated separately. The TER is then calculated using the following formula:

$$TER_{2013} = C_H \times FF + C_{PF} + C_L$$

The target for an oil heated dwelling would therefore be set at a different level to an electrically heated one. The emissions associated with a given fuel then make achieving the TER either easier or harder. For England (and for Wales), the fuel factors adopted are set out below.

Fuel Type	Fuel Factor
Mains Gas	1.00
LPG	1.06
Oil	1.17
B30K	1.00
Grid Electricity	1.55
Solid Mineral Fuel	1.35
Solid Multi Fuel	1.00
Any Fuel with CO ₂ Emission Factor Less than that of Mains Gas	1.00

Table 2: Fuel Factor for Different Fuel Types

Limiting Fabric Standards

ADL1A sets out area weighted limiting U-value standards for the different fabric elements of the dwelling. This provision is included to make the design of the dwelling robust should the performance of one fabric element, upon which achieving the TFEE is highly dependent, fail or perform less well than expected.

The limiting U-values for the different fabric element types are shown in Table 3. It is of note that the use of the limiting U-values will almost certainly result in the dwelling failing to achieve the required TER and TFEE, thus U-values, significantly better than those shown, are likely to be required.

NB The values shown in Table 3 are not the U-values that should be adopted for compliance with the Building Regulations. For guidance, see the ‘Simplifying the Complex’ section of this document.

Fabric Element	Area Weighted Average U-value (W/m ² ·K)
Roof	0.20
Wall	0.30
Floor	0.25
Party Wall	0.20
Windows, Roof Windows, Rooflights & Doors	2.00

Table 3: Limiting Fabric Parameters

Limits for Air-Permeability & Fixed Building Services

A limiting value of 10 m³/hr/m² at 50 Pa is set for air-permeability. In addition, limits are also given for the energy performance of the fixed building services installed in the dwelling, the minimum energy efficiency standards for which are set out in the Domestic Building Services Compliance Guide.

Compliance with Approved Document L1A - New Dwellings (Wales)

The 2014 edition of ADL1A for Wales came into effect on 31st July 2014. The guidance given is applicable to non-exempt building work originating from plans and notices submitted to a building control body (BCB) for approval on or after this date.

Setting the targets

ADL1A for Wales adopts a 'whole building' approach to minimising CO₂ emissions and fabric energy efficiency. A new dwelling must be designed and built such that its DER is no worse than its TER.

A 'notional dwelling' of the same size and shape as the 'actual dwelling', built to a concurrent specification, is used to determine the TER. The ADL1A 2014 notional dwelling specification is summarised in Appendix B of ADL1A and detailed in Appendix R of SAP 2012. The main elements of the concurrent specification of the notional dwelling that relate to the opaque building fabric are shown in Table 4. Whilst the concurrent specification helps to set the target, the actual specification can and will differ from this.

Element	Value
All Roofs	0.13 W/m ² -K
Walls	0.18 W/m ² -K
Floors	0.13 W/m ² -K
Party Walls	0.00 W/m ² -K
Windows, Roof Windows, Glazed Rooflights & Glazed Doors	1.40 W/m ² -K / g-value 0.63
Opaque Doors	1.00 W/m ² -K
Semi Glazed Doors	1.20 W/m ² -K
Air-tightness	5.00 m ³ /hr/m ² at 50 Pa
Linear Thermal Transmittance	Standardised ψ-values (see Appendix R of SAP 2012)
Thermal Mass	Medium

Table 4: Selected Reference Values from the ADL1A 2014 Notional Dwelling Specification

For differing main heating fuels, the target is adjusted based on a fuel factor associated with the main heating fuel to be used, using the same formula and fuel factors as with the English approach.

Rather than adopting the TFEE / DFEE approach adopted for the English 2013 building regulations change, the Welsh standards have instead adopted more robust area-weighted limiting fabric standards.

Limiting Fabric Standards

ADL1A (Wales) sets out area weighted limiting U-value standards for the different fabric elements of the dwelling. This provision, which is mandatory, is included to make the design of the dwelling robust should the performance of one fabric element, fail or perform less well than expected.

The limiting U-values for the different fabric element types are shown in Table 5. It is of note that the use of the limiting U-values will almost certainly result in the dwelling failing to achieve the required TER, thus U-values, significantly better than those shown, are likely to be required.

NB The values shown in Table 5 are not the U-values that should be adopted for compliance with the Building Regulations. For guidance, see the ‘Simplifying the Complex’ section of this document.

Fabric Element	Area Weighted Average U-value (W/m ² ·K)
Roofs	0.15
Walls	0.21
Floors & Indoor Swimming Pool Basins	0.18
Party Walls	0.20
Windows, Roof Windows, Rooflights & Doors	1.60

Table 5: Area Weighted Limiting Fabric Parameters

Limits for Air-Permeability & Fixed Building Services

A limiting value of 10 m³/hr/m² at 50 Pa is set for air-permeability. In addition, limits are also given for the energy performance of the fixed building services installed in the dwelling, the minimum energy efficiency standards for which are set out in the Domestic Building Services Compliance Guide.



Compliance with Section 6 (Energy) - Domestic (Scotland)

The 2015 edition of the Section 6 (Energy) Domestic standard (applicable for works from October 2015), gives guidance to ensure that effective measures for the conservation of fuel and power are incorporated into dwellings. This is done through requirements for a better performing building fabric and improved carbon dioxide emissions targets.

This part of the Technical Bulletin reflects on the guidance available for domestic properties from October 2015.

Setting the targets

The Technical Handbook adopts a 'whole building' approach to minimising CO₂ emissions and fabric energy efficiency. A dwelling must be designed and built such that its DER is no worse than its TER.

A 'notional dwelling' of the same size and shape as the 'actual dwelling', built to a concurrent specification, is used to determine the TER. The notional dwelling specification for each fuel type is summarised in Section 6.1 of the domestic Technical Handbook. The main elements of the concurrent specification of the notional dwelling that relate to the opaque building fabric are shown in Table 6. Whilst the concurrent specification helps to set the target, the actual specification will usually differ from this.

For the Scottish standard, following this specification and the other elements of the simplified approach is considered to satisfy the requirements of the building standards, but should not be used where there is any deviation from the packages which would result in higher CO₂ emissions. An Energy Performance Certificate (EPC) will still be required on completion of the dwelling, which necessitates SAP calculations to be undertaken in any respect.

Element or System	Gas (Package 1)	LPG (Package 2)	Oil (Package 3)	Electricity (Package 4)	Biomass (Package 5)
All Roofs	0.11 W/m ² -K	0.11 W/m ² -K	0.11 W/m ² -K	0.11 W/m ² -K	0.11 W/m ² -K
Walls	0.17 W/m ² -K	0.17 W/m ² -K	0.17 W/m ² -K	0.17 W/m ² -K	0.17 W/m ² -K
Floors	0.15 W/m ² -K	0.15 W/m ² -K	0.15 W/m ² -K	0.15 W/m ² -K	0.15 W/m ² -K
Openings	1.4 W/m ² -K	1.4 W/m ² -K	1.4 W/m ² -K	1.4 W/m ² -K	1.4 W/m ² -K
Allowance for Thermal Bridging	0.08 x total exposed surface area	0.08 x total exposed surface area	0.08 x total exposed surface area	0.08 x total exposed surface area	0.08 x total exposed surface area
Open Flues	None	One	One	None	One
Heating System, Pump in Heated Space	Gas boiler room – sealed fan flued 89% efficiency	LPG boiler room – sealed fan flued 89% efficiency	Oil boiler room – sealed fan flued 90% efficiency	Air to water heat pump 175.1% efficiency	Wood pellet boiler 86% efficiency, HETAS approved
Heating System Controls	Time and temperature zone control + boiler interlock + weather compensation + delayed start	Time and temperature zone control + boiler interlock + weather compensation + delayed start	Time and temperature zone control + boiler interlock + weather compensation + delayed start	Time and temperature zone control	Time and temperature zone control + delayed start
Hot Water (HW) System	Stored HW (from boiler), separate time control for space and water heating	Stored HW (from boiler), separate time control for space and water heating	Stored HW (from boiler), separate time control for space and water heating	Stored HW (electric immersion), separate time control for space and water heating	Stored HW (from boiler), separate time control for space and water heating
Secondary Space Heating	None	10% closed wood log-burning room heater	10% closed wood log-burning room heater	10% electric	none
Heat Recovery Systems	Instantaneous waste water heat recovery system, 45% efficiency	Instantaneous waste water heat recovery system, 45% efficiency	Instantaneous waste water heat recovery system, 45% efficiency	Instantaneous waste water heat recovery system, 45% efficiency	Instantaneous waste water heat recovery system, 45% efficiency
Photovoltaics	Yes	Yes	Yes	No	No
Air-tightness	7 m ³ /hr/m ² at 50 Pa				
Linear Thermal Transmittance	0.08 x total exposed surface area				
Thermal Mass	The value identified for the proposed building should be used				

Table 6: Selected Reference Values from the Section 6 (Energy) – Domestic Notional Dwelling Specification



Compliance with Section 6 (Energy) - Domestic (Scotland)

This approach differs from that used for England and for Wales, in that there is no adjustment to target setting based on a fuel factor. Instead, the actual concurrent specification used for target setting differs depending on the main heating fuel type chosen.

Limiting Fabric Standards

Scottish Building Standards Section 6 sets out area weighted limiting U-value standards for the different fabric elements of the dwelling. This provision, which is mandatory, is included to make the design of the dwelling robust should the performance of one fabric element, fail or perform less well than expected.

The limiting U-values for the different fabric element types are shown in Table 7. It is of note that the use of the limiting U-values will almost certainly result in the dwelling failing to achieve the required TER, thus U-values, significantly better than those shown, are likely to be required.

NB The values shown in Table 7 are not the U-values that should be adopted for compliance with the Building Regulations. For guidance, see the 'Simplifying the Complex' section of this document.

Fabric Element	Area-weighted average U-value (W/m ² K) for all elements of the same type	Individual element U-value (W/m ² K)
Roofs	0.15	0.35
Walls	0.22	0.70
Floors	0.18	0.70
Party Walls	0.2	
Windows, Roof Windows, Rooflights & Doors	1.6	3.3

Table 7: Limiting Fabric Parameters

Limits for Air-Permeability & Fixed Building Services

There is no firm limiting value set for air-permeability, however a recommended limiting value of 10 m³/hr/m² at 50 Pa is given. In addition, limits are also given for the energy performance of the fixed building services installed in the dwelling, the minimum energy efficiency standards for which are set out in the Domestic Building Services Compliance Guide.

Simplifying the Complex

Each of the building standards guidance documents now offer a straightforward elemental route to compliance. If the actual dwelling is built entirely to a notional dwelling specification, it should meet the CO₂ emissions and fabric energy efficiency targets, as well as the limiting values for individual fabric elements and fixed building services.

Nonetheless, there is scope for flexibility, should developers want it. Developers can, if they prefer, choose to diverge from the notional dwelling specification, so long as the dwelling 'as built' achieves, or exceeds, the TER (and TFEE for England), as well as the limiting values.

The *Kingspan TEK® Building System*, of structural insulated panels (SIPs), offers an 'out-of-the-box' route to compliance. SIPs can achieve a much lower air-tightness value than that proposed by the notional dwelling specification. The closed cell structure of the rigid urethane core of the *Kingspan TEK® Building System* panels does not allow movement of air within them. Also, the proprietary jointing system can create a very air-tight structure with air leakage levels as good as 0.07 air changes per hour at normal pressures (approximately 1 m³/hour/m² at 50 Pa).

SIPs can achieve improved linear thermal transmittance values due the continuity of insulation at junctions and openings. Kingspan Insulation has had a number of the junctions detailed in the *Kingspan TEK® Building System Standard Details Handbooks* modelled and ψ -values calculated for them. For further information and an expanded set of junctions, details and ψ -values, please contact the Kingspan Insulation Technical Services Department (see rear cover).

Solutions for Compliance

Constructions & U-values

Set out in the following page are examples of constructions using the *Kingspan TEK® Building System*, which are designed to comply with the requirements of each of the building standards.

The example constructions are accompanied by tables, for England & Wales, and Scotland, which detail the different components of the specification. It is important to note that the U-values are valid only for the illustrated construction. Contact the Kingspan Insulation Technical Service Department if calculations for other constructions are required.

The scenario is modelled on a typical two-storey detached dwelling with a total floor area of 163.61 m². Possible alternative solutions using other common insulation materials are shown for the purpose of comparison. The floor construction for all three solutions is the same.

U-values have been calculated using the methods detailed in:

- BS EN ISO 6946: 2007 (Building components & 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 BR 443 (Conventions for U-value calculations).

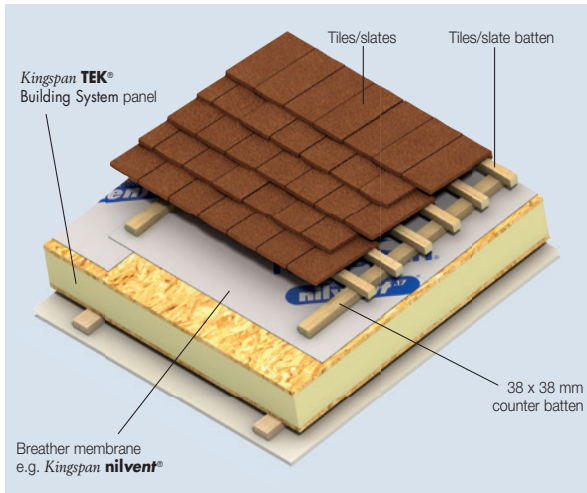
For the purpose of these calculations the standard of workmanship has been assumed good, and therefore the correction factor for air gaps has been ignored.

All figures quoted are for guidance only. A detailed U-value calculation and a condensation risk analysis should be carried out for each project. In which case, contact the Kingspan Insulation Technical Service Department for assistance.

Structural Insulated Panels

The constructions below will meet the requirements of the building standards in England, Wales & Scotland.

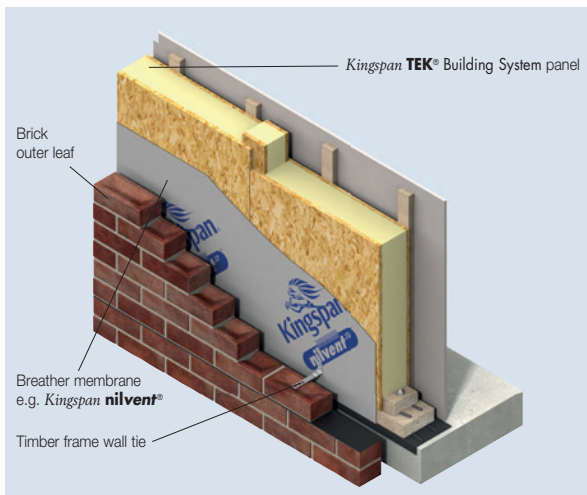
Kingspan TEK® Building System (172 mm panels) Pitched Roofs



OVERALL
281
THICKNESS

Figure 1

Kingspan TEK® Building System (172 mm panels) Walls 102.5 mm Brickwork Outer Leaf



OVERALL
365
THICKNESS

Figure 2

Constructions & U-values

Approved Document L1A – New Dwellings (England & Wales)

	Scenario 1 <i>Kingspan TEK® Building System (172 mm)</i>	Scenario 2 Timber Frame with Mineral Fibre	Scenario 3 Masonry Full Fill with Mineral Fibre
Floor (W/m ² ·K)	0.18	0.18	0.18
Wall (W/m ² ·K)	0.16 (365 mm)	0.16 (460 mm)	0.16 (453 mm)
Roof (W/m ² ·K)	0.15 (281 mm)	0.15 (464 mm)	0.15 (464 mm)
Airtightness (m ³ /m ² /hr @ 50 Pa)	3.0	7.0	7.0
Thermal Mass	Low (100)	Low (100)	Medium (250)
Thermal Bridging	13.364 (y=0.033)	22.665 (y=0.055)	22.665 (y=0.055)
Additional Measures	MVHR, standard central heating pump in heated space, 180 litre boiler fed water tank.	MVHR, standard central heating pump in heated space, weather compensator, 180 litre boiler fed water tank, waste water heat recovery.	MVHR, standard central heating pump in heated space, weather compensator, 250 litre boiler fed water tank, 55 litre solar storage, waste water heat recovery.
TER	17.01	17.01	17.08
DER	15.80	16.98	17.07
TFEE	64.60	64.60	64.60
DFEE	54.30	59.80	62.50

Table 8: Constructions designed to comply with the requirements of ADL1A

NB These calculations assume a condensing gas boiler, radiators with time and temperature zone control and low energy lighting.

Section 6 (Energy) – Domestic (Scotland)

	Scenario 1 <i>Kingspan TEK® Building System (172 mm)</i>	Scenario 2 Timber Frame with Mineral Fibre	Scenario 3 Masonry Full Fill with Mineral Fibre
Floor (W/m ² -K)	0.18	0.18	0.18
Wall (W/m ² -K)	0.16 (365 mm)	0.16 (460 mm)	0.16 (453 mm)
Roof (W/m ² -K)	0.15 (281 mm)	0.15 (464 mm)	0.15 (464 mm)
Airtightness (m ³ /m ² /hr @ 50 Pa)	3.0	7.0	7.0
Thermal Mass	Low (100)	Low (100)	Medium (250)
Thermal Bridging	13.364 (γ=0.033)	22.665 (γ=0.055)	22.665 (γ=0.055)
Additional Measures	MVHR, A rated central heating pump in unheated space, weather compensator, 180 litre boiler fed water tank, 0.75 peak kW photovoltaics	Natural ventilation with 5 fans, A rated central heating pump in unheated space, weather compensator, 180 litre boiler fed water tank, 1.40 peak kW photovoltaics, waste water heat recovery.	Natural ventilation with 5 fans, A rated central heating pump in unheated space, weather compensator, 180 litre boiler fed water tank, 1.40 peak kW photovoltaics, waste water heat recovery.
TER	12.30	12.30	13.65
DER	12.20	12.20	13.54

Table 9: Constructions designed to comply with the requirements of Section 6 (Energy) – Domestic

NB These calculations assume a condensing gas boiler, a standard central heating pump in a heated space, radiators with time and temperature zone control and low energy lighting

Customer Service

Tel: 01544 388 601

Fax: 01544 388 888

email: customerservice@kingspantek.co.uk

Literature & Samples

Tel: 01544 387 384

Fax: 01544 387 484

email: literature@kingspantek.co.uk

Technical Advice

Tel: 01544 387 382

Fax: 01544 387 482

email: technical@kingspantek.co.uk

General Enquiries

Tel: 01544 388 601

Fax: 01544 388 888

email: info@kingspantek.co.uk



Kingspan Insulation Ltd

Pembridge, Leominster, Herefordshire HR6 9LA, UK

www.kingspantek.co.uk

© Kingspan, Nilvent, TEK and the Lion Device are Registered Trademarks of the Kingspan Group plc in the UK and other countries. All rights reserved.

Kingspan Insulation Ltd. Registered in England & Wales, No. 01882722. Registered Office: Pembridge, Leominster, Herefordshire HR6 9LA UK.