15NP0057

Condition 10

Renewables and energy.

In accordance with our own beliefs and to pursue the aims of Core policy 25 the construction of the home is to reach as near Passivhaus principles as we can financially achieve.

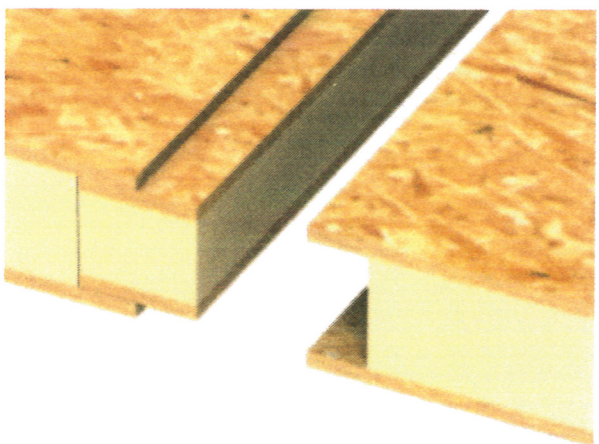
Passivhaus is a certification scheme for buildings which have extremely low levels of energy input requirement (for space heating principally). In principle, a passive home will be so well insulated and designed that sufficient heat is obtained by passive means – solar gain and incidental heat sources, human and mechanical in the home, for the comfort of the occupants. Even without heating, a passive house should not fall below 16c inside at any time of year. The certification however typically costs £1800+ and since this house is intended to be our permanent dwelling, so resale value is of no interest to us, we are not seeking Passivhaus certification.

However, a target of ≤15Kw/m2 per year heating requirement has been aimed at in the design. To put this in perspective to other house builds in the village over recent years, the average new build *to regulation* in the UK achieves 65Kw/m2, and older properties typically *substantially* worse.

This miniscule energy input is to be achieved by a fabric first approach and was central to the brief for the architect. In total, we have been researching and working on this for over 3 years. The structure of the house will feature an insulated slab, heated by under floor heating (UFH) which requires much lower temperatures than do traditional radiator systems, and thus much lower fuel input. When combined with extremely high levels of insulation, and rigorous draft proofing, the fuel requirement falls even more.

The load bearing structure and roof are to be of SIPs (Structural Insulated Panels, achieving a U-value 0.13 compared to the part L regulation of 0.18, a truly significant difference). O*ver and above this*, the outer wall will be of reclaimed stone, with a 50mm air gap, reducing outer skin heat loss of the SIPs panels even more than in the case with rendered SIPs panels as there will be no direct moving air flow across them. Wall ties between the two constructions are to be of the fibre type (<0.7W/mK) to prevent the cold bridging experienced with metal wall ties.
Cable and pipe entries are minimised, grommeted and caulked to prevent any uncontrolled draft whatsoever. Internal floors are hung and thus do not extend through the insulated envelope either, removing cold bridging entirely from their construction.

The *Kingspan* **TEK**® Building System's proprietary jointing system can create a very air-tight structure. Air leakage levels can be as good as 0.08 air changes per hour at normal pressures (approximately 1 m³/hour/m² at 50 Pa).



The insulation beneath the insulated slab, is to marry with the insulation element in the SIPS, meaning the entire interior of the house is enclosed by an insulated envelope. Further to this, design detail in window and door frames ensures a thermal break so no cold bridging to outside can occur there either. The SIPs panels chosen interlock as shown in this diagram, The outer skin of the SIPs panel construction (of which the roof is also created) is then covered in a vapour permeable membrane and all joins and gaps sealed with special-to-task long life tapes

Typical Constructions and U-values

Assumptions

The U–values in the tables that follow have been calculated, under a management system certified to the BBA Scheme for Assessing the Competency of Persons to Undertake U–value and Condensation Risk Calculations, using the method detailed in BS / I.S. EN ISO 6946: 2007 (Building components and building elements. Thermal resistance and thermal transmittance. Calculation method) and using the conventions set out in BR443 "Conventions for U–value calculations".

The U–values in the tables that follow are valid for the constructions shown in the details immediately above. Unless otherwise stated, the U–values quoted are based on an internal construction comprising a 3 mm plaster skim on 12.5 mm plasterboard fixed to 50 x 25 mm softwood timber battens. The external finishes are as specified in the examples themselves.

NB: For calculations which do not feature additional internal insulation, a 4% bridging factor has been assumed for walls and 1% for pitched roofs. The thermal conductivity of the timber has been assumed at 0.12 W/m·K.

NB: Calculations assume that the use of a foil faced breather membrane yields an airspace thermal resistance of 0.54 m²·K/W.

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

NB: The figures quoted are for guidance only. A detailed U-value calculation together with condensation risk analysis should be completed for each individual project.

NB: If your construction is any different to those specified and / or to gain a comprehensive U–value calculation along with a condensation risk analysis of your project please consult the Kingspan Insulation Technical Service Department for assistance (see rear cover).

Kingspan **TEK®** Building System **Walls with 102.5 mm Brickwork Outer Leaf**

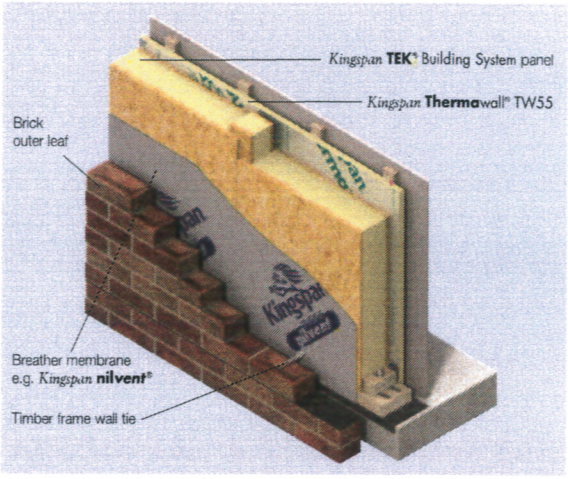


Figure 1

U–values (W/m²·K) for *Kingspan* **TEK®** Building System Walls with Various Thicknesses of Additional Insulation and Different Breathable Membranes

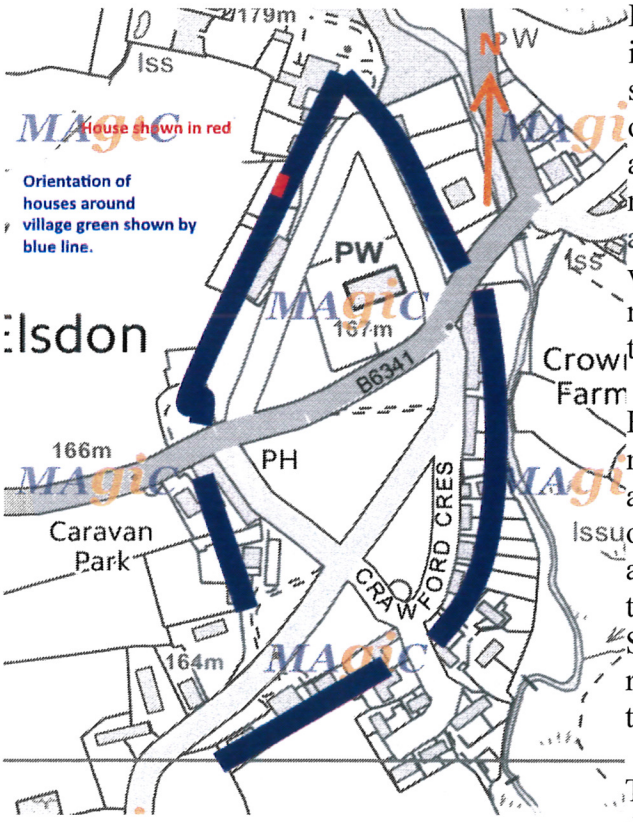
Thickness of *Kingspan* **TEK®** Building System Panels (mm)	Thickness of *Kingspan* **Thermawall®** TW55 (mm)	U–value	
		Standard Breathable Membrane	Foil Faced Breathable Membrane
142	0	0.19	0.18
142	20	0.15	0.14
142	25	0.15	0.14
142	30	0.14	0.13
142	40	0.13	0.13
142	50	0.12	0.12
142	60	0.12	0.11
142	70	0.11	0.11
142	75	0.11	0.10
142	80	0.11	0.10
142	90	0.10	0.10

and foam to create as near an air-tight seal as is technically achievable. The rigid urethane insulation in these panels is manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

The attention to detail in the sealing of the house from any drafts and/or uncontrolled air flow extends to there being no trickle vents on windows or similar. Because a wooden door is required on the front of the porch, an exterior level door is to be fitted inside between the porch and the house, removing uncontrolled air flows from letterbox, keyholes etc. from the equation. Fresh air enters the house via a mechanical ventilation system which delivers air to each room, stale air being removed and going through a heat exchanger with an 80%+ efficiency rating. This recovered heat is transferred to the incoming fresh air. By these means, heat loss and thus energy input requirement is lowered to an absolute minimum achievable at present levels of technology (appliances are all A+ rated at minimum, and lighting is all LED, reducing energy input even further).

Use of solar renewables and solar gain potentials are seriously limited by the orientation of the house, the orientation being required to fit in with the village envelope and orientation of surrounding properties.

There being no South facing roof even to a slight degree acceptable by the solar energy companies we have contacted, we have even taken plans to solar firms at exhibitions (National self-build shows for the last 3 years at Birmingham and Harrogate) to no avail. Solar water and P.V have unfortunately been deemed to be unviable. The possibility of external and ground mounted arrays was explored, but costs were *highly* prohibitive and difficult to fit aesthetically in the locale.



Biomass was explored, but because of the high insulation levels and low energy requirement, no system is currently manufactured with a *low enough* output, and serious overheating would occur with any of the currently available systems, which are not designed for such low output levels. As we have access to genuinely renewably sourced firewood very cheaply, this was unfortunate. Again, manufacturers both in the UK and Europe were tried with no success.

However the building has been designed with a number of windows (27 units) to take as much advantage of what solar gain can be achieved in the orientations available, including skylights. Windows are to be triple glazed and of U-levels well beyond that of mainstream window manufacturers. Specifications sent out for quotes have been required to come back with values equal to or better than 0.85u (building regs only require 1.6u).

Therefore, an air source heat pump has been decided upon as the primary heating source, being most suitable to low temperature heating systems such as the UFH system being installed in this house.