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What Building Specification Do I Need?

In the 20th Century it was pretty simple. Providing you observed some basic rules regarding fire, structural stability, public health and functional requirements which were codified in 1985, you had more or less free choice.

In ancient Babylon the rules were fairly succinct.

A basic background to British Building Regulations can be found on these web sites.

https://www.charnwood.gov.uk/pages/testlinkpage
http://www.buildinghistory.org/regulations.shtml
https://www.bsria.co.uk/information-centre/legislation/building-regulations/

Then things changed,

The Climate Change Agenda

Following the first “Earth Summit” held by the United Nations in Rio de Janeiro in June 1992 Building Regulations became the main tool for reducing the impact that (new) buildings have on Climate Change. With carbon dioxide (CO₂) seen as a major factor in Global Warming, in 2008 a Code for Sustainable Homes was introduced as a national standard by the UK Government as an environmental assessment method for rating and certifying the performance of new homes. This replaced the BRE Global’s EcoHomes scheme with the aim of encouraging continuous improvement in sustainable home building.

1 In the UK, the first national Building Regulations, introduced in 1965, underwent many amendments until the Building Act 1984 enabled the format of the regulations to be changed into a simple catalogue of basic functional requirements for buildings in 1985. These were supported by codes of practice, known as Approved Documents, enabling more detailed prescriptions to be made for building design than previously possible. Today these are essential for the constant introduction of new building design requirements, e.g. to address the causes of climate change. The 1984 Building Act also allowed private Approved Building Control Inspectors as an alternative to local authorities.
Progressively both the EU & UK have legislated for higher and tighter standards to reduce energy use, encourage on-site energy production, and to promote the use of renewable and recyclable materials and methods of construction.

**Changing The Way We Build**

Faced with the disconcerting fact that even as late as 2004 UK housing stock was amongst the least energy efficient in Europe, accounting for 30%+ of all UK energy use (including space heating, hot water, lighting, cooking, and appliances), Building Regulations have become a key driver for securing Energy Efficiency in new buildings.

With the aid of supporting bodies like Zero Carbon Hub and Energy Saving Trust, the way that we build our homes has been irreversibly changed.

To design and build your new home today requires the consideration of a wide number of elements and the calculation of how well these all work together to target the building’s energy performance and then to ensure that it is built to deliver no less than what was predicted.

**Fabric First**

In their guide to Fabric First, the Energy Saving Trust considers specific approaches and techniques for reducing CO2 emissions by improving the fabric of buildings. These include:-

- Reducing the U-values of mass or thermal elements
- Reducing the effects of thermal bridging
- Effective airtightness and ventilation strategies
- Consideration of other service improvements

Taking note of this means that during the design of your new home you – maybe in conjunction with an architect – must take a scientific approach to considering the performance of the total ‘building envelope’.

The building envelope includes the foundations, ground (or basement) floor, the external walls, doors and windows, and the roof. It is their interface with the world outside your home. The extent to which they can provide an effective and efficient thermal barrier between the space inside and the environment outside is really important in deciding how much energy is needed to keep everyone comfortable inside, no matter what the weather is doing outside.

This goes well beyond how well the structure is insulated and the U-values of individual components. It requires all of these to be assessed together for SAP (Standard Assessment Procedure) which is now also used to assess energy performance for the UK Governments Green Deal, the TER (Target Energy Ratings) and the BER (Building Emission Rates)

**Good Fabric is More than Insulation**

In addition to insulation, the design of the building envelope now requires consideration of:-

- **Topographical Design** Although not assessed with any great accuracy under SAP (which takes only basic solar orientation into account), this is perhaps the logical starting point for the design of any new building. It requires an assessment of the total site consideration, e.g. orientation, slope, surrounding buildings and natural vegetation (trees) and their impact on the energy requirements of the building. Shading, for instance, may affect the amount of solar energy that it receives, likewise whether it is on a south or north facing slope will impact on the total energy considerations. Sun and wind both affect the amount of heating or cooling that will prevail.
• **thermal bridging** (cold bridging) between the outside and inside. The better insulated a house is, the more important this becomes. Ignoring it can lead to internal cold spots, condensation, damp and mould where the thermal bridge occurs. This is particularly important at, for example, the junction of window and door frames with the walls and on corners.

• **air leakage** and the avoidance of uncontrolled heat loss (or gain) through the fabric. Up to 40% of heat loss can be attributable to such air permeability in poorly designed buildings. The building regulations set permissible levels for this and require that buildings are **tested for air tightness** to see that they achieve the targeted levels before occupation. In buildings which are very airtight, e.g. **Passiv Haus** standards, additional means of ventilation may be necessary to avoid the air inside becoming stale and unhealthy. In such cases it is usually necessary to install an MVHR (**Mechanical Ventilation and Heat Recovery**) or other system of ventilation. Although these have the advantage of enabling up to maybe 90% of the heat inside a house to be recovered as it is exchanged with cold air brought in from outside, the costs of this in terms of design, installation and maintenance can be considerable.

• **Passive Solar Building Design** uses the building envelope to collect, store and distribute solar energy for heat in winter whilst seeking to avoid this in summer.

• ** Thermal mass** or the ability of a building to absorb heat from the sun / environment during the daytime and lose, or emit this at night time. The inertia or ‘**thermal flywheel**’ effect may be used as part of a buildings energy design. The degree to which the materials used and the **design strategy** are heavyweight or lightweight will affect the choice of heating and cooling systems.

• **Overheating** although not clearly defined, there is increasing concern that modern, highly insulated, airtight buildings may be prone to overheating. This can range from making it difficult or uncomfortable to sleep at night, to becoming dangerous to health, particularly for the elderly. Amelioration can be costly.

• **Solar Gain** through the windows directly into the rooms, but also through walls and the roof (see below). While this can be a cheap / no cost source of heating a building, it can also become a real problem, for example where very large windows face the sun. In such cases it may be necessary to use reflective materials. It is very important that this be considered from the outset of designing the building so as to incorporate, for example, appropriate glazing or sun shading, e.g. ‘**brise-soliel**’ or sun breakers.

• **Roof Design** which may be a so called ‘cold roof’ where the insulation is put immediately above the top floor ceiling (not possible for vaulted / cathedral ceilings) or a ‘warm roof’ where the insulation is incorporated in the external roof structure keeping the (loft) space warm. This is necessary where ‘vaulted’ or ‘cathedral;’ ceilings are to be used, or where the roof space is to be habitable space. Either of which might be a ‘**green roof**’ which can be thin and provide no real insulation value, or thick, as with the earth, turf and other planting used in, for example, some Nordic countries and North America. **Inverted roofs** are a variation usually used for flat roofs and where the waterproofing may be below the insulation. In wintertime any snow covering a roof will act as an additional insulation blanket (but **Snow Loading** must be considered, particularly for low pitch and flat roofs. It is a structural engineering calculation which relies on a national **geographical assessment**)

• **Wind exposure** will affect the extent and speed at which a building may cool down. (It is also a necessary consideration to determine the loads placed on, in particular, the walls and roof of the building. These include both the pressure and vacuum effect that wind forces have both on the heating/cooling and long term stability of the structure.)
• **Embodied Energy** that is to say the energy used in winning, transporting, processing, manufacturing, incorporating and using the building elements involved.

As will be evident to any designer, the type of materials and components selected for any of these requirements for the fabric of the building envelope will have an effect both on the design and the costs of the resultant building.

**Energy Saving Sustainable Buildings**

However, the design of sustainable buildings does not end here and many of the other elements and components also have an impact on the envelope.

**Services**
Detailing and workmanship are critical for achieving good airtightness. For instance, poor location of services and positioning of power points, lights and switches can create penetrations in the envelope that lead to air leakage and loss of heat.

**Windows**
The amount of daylight, window exposure, and type and positioning of lighting will affect the energy usage calculations. Both of these will determine how energy efficient the building is designed to be and – combined especially with the quality of workmanship and the topographical situation - how much energy is actually used in practice.

This is so important that major house-builders, for example, will design to very tight glazed areas and the ratio of perimeter to ground floor area of a house for the calculation of U-values, so as to minimise their fabric requirements (and hence build costs),

**Water**
Water consumption must also be considered, with the harvesting and storage of rainwater and even recycled ‘grey’ water being assessed. How both ‘foul’ water from toilets and washing, as well as rainwater, should be disposed of is becoming increasingly important. Most require energy for processing and transporting, but they can also impact on the environment via run-off or return to groundwater.

**Energy Source**
How the energy used in a home is produced and where it comes from is also an increasingly important consideration. ‘On-site’ generation via, for example, solar photo-electric panels (PV) or micro combined heat and power (micro CHP) units is equally as importance as the source of heat as in bio mass (usually wood) burners and ground source and air source heat pumps (which still need electricity to operate them).

**Design Decisions**
These are just some of the other things that your designer should take into consideration. However, it will mean you have to make quite a lot of decisions regardless of the level of performance and specification that you want to achieve. All of these will, of course, have implications for, and be affected by, the Building Regulations.

**The road to ‘Zero Carbon’ is paved with Building Regulations**

As will now be clear, Building Regulations are now an even more important consideration for the design of any building. Compliance is no longer via the ‘elemental route’. Instead the approach is now one of whole building performance, with particular emphasis on the limitation of CO₂ emissions.
Targets are set by computerised modelling of a comparison against a ‘notional’ building of similar design, but built to 2002 standards and applying the improvement factors required for approval. However, these allow design flexibility, permitting various ways of achieving the improvements within the limits set by Kyoto. The UK national targets for all buildings were to reduce CO₂ by 20% by 2010, between 26-32% by 2020; with an aspiration of 60% by 2050.

The Climate Change Act established the 2020 and 2050 goals as legal targets, set 5-year “budgets” for emissions and established an advisory Climate Change Committee. It also enabled legal challenges to be brought on any failure to meet targets.

Current EU targets for 2020 – to which the UK is signed up - require a 20% reduction in CO₂ with the UK being committed to achieving Zero Carbon for new build homes by 2016.

The Climate change agenda for homes is supported by:-
- Part L of the Building Regulations etc. together with amendments.
- Code for Sustainable Homes and detailed technical guidance.
- Energy Performance Certificates.
- Moves in planning legislation

More Information
More information related to these consideration can be found on the internationally collaborative web site Designing Buildings Wiki and on the UK Government’s Approved Document L1A – Conservation of Fuel & Power (New Dwellings) 2013 edition.

Our ‘Optimised Specification’ Approach to Design

Understandably, Architects, Surveyors, House-builders and Self Builders all want to minimise costs and maximise performance in the fastest, most efficient and least complicated way possible.

But, as the foregoing illustrates, designing and specifying the methods, components and materials to be used in any building is now far more involved than it was even a few years ago. And, as Governmental aspirations for all new buildings to be ‘Zero Carbon’ by 2016 are implemented, this is getting even more complicated and involved.

‘Green Dreams’ – Your Ready Made Solutions
Cost consciously, we have optimised a small number of specifications to enable you to choose the ‘Green Dream’ building performance level that you want.

You can still choose our basic Green Dream Home kit and then ‘mix and match’ the individual components that you want. But choosing either a Bronze, Silver or Gold Green Dream eco kit cuts out the expense and hassle of having to ‘re-invent the wheel’ yourself.

Green Dreams Cut Fuel Bills
Each specification pre-selects the fabric of the building envelope and the materials to achieve each level. Each ‘Green Dream Home’ is therefore ‘value engineered’ with the costs of both construction and operation very much in mind. Choosing one of these specifications makes it swift and simple to know what you need to do and get the best possible price.
Low Cost Green Dream Eco Kits
Packaging each Green Dream eco-kit in this way means we can give you the keenest prices around – generally the same as you would have to pay your local builders merchant, but without having to worry about material take-offs, scheduling individual deliveries, and – perhaps even more importantly – with much of the work being done off-site in our dry factory controlled environment.

Flexible Green Dreams
Recognising that specialist designers, home builders and self builders may want greater leeway than the rigid lowest cost approach taken by the big national house builders, our optimised specifications and system of construction provides more flexibility on, for example, glazed areas and footprint shape.

What we have done is to provide progressively increasing inclusive specifications that allow you to improve the relationship between your fuel bills and your building costs – the ‘payback period’ that makes it financially worthwhile spending more to save more.
Choosing one of these specially selected specifications is slightly less costly than choosing them individually.

- ‘Base’ – a ‘Compliance+’ specification for the shell of the building envelope. This provides a green eco basis for those with a technical bent who have a reasonable appreciation of the new Building Regulations and prefer ‘pick & mix’ choices. The individual choices listed are all the same as those included in the selected Bronze, Silver, Gold and Super Green selected specifications, but will cost slightly more on an individual basis.

- ‘Bronze’ - capable of meeting Code 3 without having to scratch and scrape for every last point. This does not go overboard but, equally it does not just scrape compliance on the ‘notional house’ basis of SAP calculations by the barest of margins.

- ‘Silver’ – proving reasonably easy compliance with Code 4, but since the Code is always a bit of a moving target due to the breadth of other criteria beyond energy consumption, it tries to allow a little more flexibility to gain Code ‘points’.

- ‘Gold’ - gives you a building envelope that is very close to that required for Passiv House compliance levels for energy consumption. This includes very high levels of airtightness and low levels of thermal (cold) bridging.

‘Green Dream Super’ Options
While central heating may become unnecessary with our higher choices, Green Dream Super Options offers:-

- Central heating, either under floor or radiators, from electric, air or ground source heat pump, gas, oil or biomass, solar water or PV fuelling, with the further option of micro CHP.
- Mechanical Ventilation and Heat Recovery (MVHR) system as part of the kit, including all appropriate ducting in accordance with the latest recommendations.

Options are also offered for wall cladding and roof coverings, since these are way too planning sensitive to hope to get way with a ‘standard’ brick, render, or roof tile of any sort.
Green Dream Homes – Target U-values & Air Permeability

Note: Actual performance depends on individual house design calculations, but can be adjusted.

<table>
<thead>
<tr>
<th>Approx performance</th>
<th>Eng Bldg Regs</th>
<th>Envelope Shell</th>
<th>Compliance +</th>
<th>Enhanced</th>
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<td>Code 4-5</td>
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<td>0.70/0.75</td>
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<td>Option?</td>
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Green Dream Homes – Specifications

In each case a PC sum is allowed for steel, glulam or other measures that may be specified for by the structural engineering calculations. We avoid these where engineering permits.

Likewise we allow a PC sum for any special requirements that may be specified (e.g. traditional feature entrance frames and trusses) and for which a more detailed design and specification is required.

These are intended to help you with your overall budgeting.

‘Green Dream Base’ – PEFC / FSC timbers - materials can be varied if required.
- Individually structurally engineered with calculations & NHBC 353C certificate for building regs
- Individually prepared fabrication drawings (ready for Robust Details where applicable) for your approval before manufacture
- 300mm hi-load polythene DPC, ground floor timber sole plate to suit walls, sole plate fixings
- Single 38mm ground floor sole plate + single 38mm head binder to all floors to suit walls
- External wall panels - 38x140 timbers with 9mm OSB sheathing and Tyvek Soft membrane
- 1000 gauge polythene VCL + joint sealing tapes for onsite fix to external walls by others
- Party walls & spandrels (if applicable) – 38x89 timbers with 9mm OSB sheathing to cavity side, 50mm gap between opposing party wall leaves.
- Internal wall frames - 38x89 timbers with central row of noggins, OSB sheathing per engineering
- Floor Joists & Deck – 220x45 solid joists & rim beams, 18mm OSB or 22mm chipboard sub deck, solid blocking between joists where necessary
- Timber wall stud, joists, rafter and truss spacing generally at 600mm, but up to 1200 for rafters
- Cavity barriers 45x45 sawn timber to opening surrounds, eaves and party wall tops
- Loose timber for site assembly porches and gable ladders to roof gable ends

- A ‘Weather-tight Roof’ of OSB sarking board over rafters, Tyvek Soft breather membrane and 25x38 counter-battens fixed up line of each rafter to receive tillers lath and slate / tile roof covering (by others) is strongly recommended
‘Green Dream Bronze’ - enhances and replaces elements of the Green Dream Base specification to deliver the target U-values and air permeability targeted in the table above.

- **Ground floor** – U-value 0.20 (NB: GA4000 – 75mm)
  kit includes 75mm PIR rigid insulation + 20mm ‘dry screed’ board base for floor finish to be site laid over foundation slab (slab by others) after timber frame has been erected
  *(assumes a perimeter to area (P/A) ration of 0.6, a 500 gauge polythene separating layer and a 22mm T&G chipboard floating floor above insulation)*

- **External Walls** – U-value circa 0.24 Airtightness 6.0 @ 50pa (NB: XR4000 – 120mm)
  kit includes Green Dream ‘Base’ specification + 120mm PIR rigid insulation factory fitted between studs + Tyvek Reflex breather membrane
  *(assumes weatherboard cladding externally and plasterboard and skim finish internally)*

- **Party Walls** – U-value circa 0.20 Acoustics to Robust Details EW-T-2 (NB: Flexi)
  kit includes Green Dream ‘Base’ specification + 90mm Rockwool site fixed fill between studs after shell erected with weather proof roof.
  *(assumes overall minimum wall width of 240mm including 2 layers 12.5mm plasterboard lining each side [by others]*)

- **Party Floors** – U-value circa 0.20 Acoustics to Robust Details 1 hour fire resistance (NB: Flexi)
  kit includes Green Dream ‘Base’ specification + 140mm Rockwool site fixed between joists after shell erected with nylon net under joists.
  *(assumes 2 layer 12.5mm plasterboard & skim on resilient bars under joists by others)*

- **Roof** – U-value circa 0.19 High level acoustic resistance (NB: Rockwool Flexi)
  kit includes Green Dream ‘Base’ specification + 220mm Rockwool insulation site fitted between rafters at 600 centres, 1000 gauge polythene site stapled to underside of rafters with taped joints, 9mm OSB3 roof sarking board, Tyvek soft breather membrane, 25x38 counter battens up line of each rafter (to receive tillers cross battens and roof tiles / slates
  *(assumes plasterboard and skim to underside of rafters if roof space to be habitable)*

‘Green Dream Silver’

- **Ground Floor** – U-value 0.14 (NB: XR4000 – 120mm)
  Kit includes Green Dream ‘Base’ specification + 500 gauge polythene separating layer + 150mm PIR rigid insulation + 20mm ‘dry screed’ board base for floor finish to be site laid over foundation slab (slab by others) after timber frame has been erected
  *(assumes a perimeter to area (P/A) ration of 0.6)*

- **External Walls** – U-value 0.15
  kit includes Green Dream ‘Base’ specification + 120mm PIR rigid insulation between studs + Sheathing increased to 12.5mm OSB3 + 45mm PIR insulation outside studs (factory and/or site fixed) + 25x38 batten to secure external PIR and provide fixing for external cladding or wall ties
  *(assumes weatherboard cladding externally and plasterboard and skim finish internally)*

- **Party Walls** – U-value circa 0.20 Acoustics to Robust Details EW-T-2 (NB: Flexi)
  kit includes Green Dream ‘Base’ specification + 90mm Rockwool site fixed fill between studs after shell erected with weather proof roof.
  *(assumes overall minimum wall width of 240mm including 2 layers 12.5mm plasterboard lining each side [by others]*)
• Party Floors – U-value circa 0.20  
  Acoustics to Robust Details  
  1 hour fire resistance  
  (NB: Flexi)  
  kit includes Green Dream ‘Base’ specification + 140mm Rockwool site fixed between joists after shell erected with nylon net under joists.  
  *(assumes 2 layer 12.5mm plasterboard & skim on resilient bars under joists by others)*

• Roof – U-value circa 0.19  
  High level acoustic resistance  
  (NB: Rockwool Flexi)  
  kit includes Green Dream ‘Base’ specification + 45mm PIR site fixed under rafters + Tyvek AirGuard Control site stapled to underside of rafters with taped joints + 220mm Rockwool insulation site fitted between rafters at 600 centres + 9mm OSB3 roof sarking board, Tyvek reflex breather membrane + 25x38 counter battens up line of each rafter (to receive tillers cross battens and roof tiles / slates)  
  *(assumes plasterboard and skim to underside of rafters if roof space to be habitable)*

• Windows – U-value 1.20 triple glazed  
  (Sidey Solartherm)  
  kit includes Green Dream ‘Base’ specification + factory or site fitted PVCu triple glazed solartherm windows, choice of colour outside, white inside manufactured from profiles extruded to BS12608 with sealed units to BS1279 with all toughened and laminated glass to BS6206, standard security, satin finish handles, fitted with trickle vents, ‘Scratchguard’ protected (removed by others after building complete).

• Doors – U-value 1.20 triple glazed  
  (Sidey Solartherm)  
  kit includes Green Dream ‘Base’ specification + site fitted PVCu triple glazed solargard doors, choice of colour outside, white inside manufactured from profiles extruded to BS12608 with sealed units to BS1279 with all toughened and laminated glass to BS6206, standard security, satin finish handles, ‘Scratchguard’ protected (removed by others after building complete).

• Air Permeability – <3.5 @ 50 Pa  
  (NB: Tyvek + Iso-Chemie)  
  kit includes Green Dream ‘Base’ specification + Tyvek AirGuard Control VCL and tapes site fitted behind internal wall and roof lining + Iso-Butyl Alu Tape over external joints in PIR wrap.

‘Green Dream Gold’

• Ground Floor – U-value 0.09  
  (NB: XR4000 – 200mm)  
  kit includes Green Dream ‘Base’ specification + 500 gauge polythene separating layer + 200mm PIR rigid insulation + 20mm ‘dry screed’ board base for floor finish to be site laid over foundation slab (slab by others) after timber frame has been erected  
  *(assumes a perimeter to area (P/A) ration of 0.6, a 500 gauge polythene separating layer and a T&G floating floor above insulation)*

• External Walls – nominal thickness 275 - U-value 0.10  
  (NB: PIR per ‘Silver’ + GDS060)  
  kit includes Green Dream ‘Base’ specification + 120mm PIR rigid insulation between studs + 25mm PIR insulation & 69.5mm plasterboard thermal laminate inside studs  
  *(assumes weatherboard cladding externally and plaster skim finish internally)*

• Party Walls – U-value circa 0.20  
  Acoustics to Robust Details EW-T-2  
  (NB: Flexi)  
  kit includes Green Dream ‘Base’ specification + 90mm Rockwool site fixed fill between studs after shell erected with weather proof roof.  
  *(assumes overall minimum wall width of 240mm including 2 layers 12.5mm plasterboard lining each side [by others] )*
• Roof – U-value circa 0.09  High level acoustic resistance  (NB: Rockwool Flexi)
  kit includes **Green Dream ‘Base’** specification + 45mm PIR site fixed under rafters + Tyvek AirGuard
  Reflective stapled to underside of rafters with taped joints + 220mm Rockwool insulation site fitted
  between rafters at 600 centres + 12.5mm OSB3 roof sarking board + Tyvek soft breather membrane +
  120mm PIR insulation over sarking + 25x38 counter battens up line of each rafter (to receive tillers cross
  battens and roof tiles / slates
  (**assumes plasterboard and skim to underside of rafters if roof space to be habitable**)  

• Windows – U-value 0.065 triple glazed  (M Sora Nature Passiv IZO)
  kit includes **Green Dream ‘Base’** specification + factory or site fitted triple glazed, Aluminium Clad Timber
  windows, choice of colour outside, timber inside manufactured toughened and laminated glass, standard
  security, satin finish handles, fitted with trickle vents.

• Doors – U-value 0.08 triple glazed  (M Sora Prestige Classic Ud <0.8)
  kit includes **Green Dream ‘Base’** specification + site fitted triple glazed, Prestige Classic Timber doors
  choice of colour outside, timber inside manufactured toughened and laminated glass, standard security,
  satin finish handles

• Air Permeability - <1.0 @ 50 Pa  (NB: Tyvek + Iso-Chemie)
  kit includes **Green Dream ‘Base’** specification + Iso-Connect HB Band under external panel base + Tyvek
  AirGuard Control VCL and tapes site fitted behind internal wall and roof lining +  Iso-Butyl Alu Tape over
  external joints in PIR wrap