Achieving C*f*SH Levels 4, 5 and 6

Background

The Code for Sustainable Homes was developed to encourage continuous improvement in sustainable home building. The implementation of the code is managed by BRE on behalf of the Government's Department for Communities.

The code covers nine categories of sustainable design each with a certain number of available eco-points: -

Energy and CO_2 emissions(31) Water(6) Materials(24) Surface Water Run-off(4) Waste(8) Pollution(4) Health and Wellbeing(12) Management(9) Ecology(9)

These points that cumulatively make up the building's rating. It is possible to achieve an overall level of between zero and six. In addition to meeting some minimum requirements, a house requires 57 points to be categorised as LEVEL 3, 68 for LEVEL 4, 84 for LEVEL 5 and 90 for LEVEL 6.

Providing 31 points, the category with the most influence on the final score of the dwelling is 'Energy and CO_2 emissions.' This category is then broken down into the sub-categories along with the 31 points awarded: -

DER - Dwelling Emission Rate (10) Fabric Energy Efficiency (9) Energy Display Devices (2) Drying Space (1) Energy Labeled White Goods (2) External lighting (2) Low carbon Technologies (2) Cycle Storage (2) Home Office (1)

To meet the demands of the Code, insulation increases on the walls, floors, windows etc which can leave the thermal bridge at the wall floor junction a weak link in the chain. Proportionately, heat loss through the this thermal bridge can account for about 5 to 7% of the total heat loss of a well-insulated building.

Heat loss at this thermal bridge can be reduced or even eliminated by using a thermal bridging block such as Marmox Thermoblock at the base of the inner leaf.

Code Level 3

All social housing in England, Wales and Northern Ireland have had to be at least rated Code 3 for the past few years. In Scotland, the code is not used but its precursor, the EcoHomes scheme has been modified and incorporated within Section 6 of the Scottish Building Standards.

With regard to energy and CO_2 emissions, **Level 3 equates to a 25% reduction in CO_2** emissions compared with the 2006 building regulations (part L)..... this is identical to the current UK building regulations (*part L - England, Wales, IoM, part 6 - Scotland, part F - Northern Ireland*).

Therefore by virtue of the new building regulations, for Energy and CO_2 emissions section only, Code 3 is in spirit compulsory.

The DER requirement (*aggregation of U-Values and Y-Values*) for Code 3 is the same as in the English Building Regulations, Part L; 25% better than the Target Emissions Rate that were in the 2006 Building Regulations. Using an Accredited Construction Detail will automatically allow a Y-Value of 0.08W/m^2K to be used in the SAP calculation which complies with Code Level 3.

Code Level 4

1. To be Code 4, the DER must be at least 25% better than the current TER

Although there are other factors to consider, a 25% reduction in the TER approximates to a 25% reduction in the ACD Y-Value of 0.08W/m^2K. This would bring this down to 0.06W/m^2K. Using a normal Accredited Construction Detail will not provide sufficient insulation to comply with the requirements of Code Level 4. The thermal bridging at the wall/floor junction needs addressing.

The Energy Saving Trust has suggested that the Y-Value at non-repeating thermal bridges should be no more than 0.04W/m^2K.

2. To be Code 4, the FEE must be calculated and presented as a yearly energy usage.

The other requirement of the Code is an assessment of the Fabric Energy Efficiency. This is the estimation of the total annual energy usage of the house. Marmox hold the belief that energy saving should be carried out by adopting **a fabric first approach** by specifying high levels of insulation to the thermal envelope and ensuring that this insulation is continuous from the floor into the wall.

Fabric Energy Efficiency Requirements for Code 4

The maximum estimated energy usage ***for ANY Code level*** is 48kWh/m^2/yr (*for flats and mid terraced houses*) or 60kWh/m^2/yr (*for all other houses*)

There is no mandatory level needed to achieve Code 4 but the amount of estimated energy usage must be calculated to give the associated number of points out of a maximum of nine. Clearly, the better the FEE is will give more points and therefore yield a higher Code rating.

- 3 points = 60 / 48kWh/m^2/yr
  - 4 points = 55 / 45kWh/m^2/yr
    - 5 points = 52 / 43kWh/m^2/yr
      - 6 points = 49 / 41kWh/m^2/yr
        - **7 points = 46 / 39kWh/m^2/yr**
          - 8 points = 42 / 35kWh/m^2/yr
            - 9 points = 38 / 32kWh/m^2/yr

Level 5

TWO REQUIREMENTS ARE NECCESARY.

- **To be Code 5, the DER must be 100% better than the TER**
- **7 Ene2 points are required which relates to the FEE being no greater than 46kWh/m^2/yr** (*or 39kWh/m^2/yr for flats and terraced houses*).

These requirements need documenting and presenting to a Code Assessor both at the design stage and during the construction stage.

Levels 6

TWO REQUIREMENTS ARE NECCESARY.

- **The net CO_2 emissions must be shown to be zero.**
- **Seven Ene2 points are required which relates to the FEE being no greater than** 46kWh/m^2/yr (*or 39kWh/m^2/yr for flats and terraced houses*).

Level 6 (zero carbon) does NOT require a calculation to show the DER is 100% better than the TER. This this category, the net CO_2 emissions must be shown to be zero. Furthermore it must be shown that the construction is "thermal bridge free." At least seven Ene2 credits, as with Code 5 are required for classification as Code 6.

All this information is available on planning portal and summarized on website of the Energy Saving Trust.

energy saving trust

Thermal Bridging

Limiting thermal bridging Repeating thermal bridges within the planes of the construction will be accounted for within the U-value calculations, however junctions between elements (non-repeating thermal bridges) need special consideration. For further guidance see 'Accredited Construction Details'[3] and BRE information paper IP1/06 'Assessing the effect of thermal bridging at junctions and around openings'.[4]	It is acceptable to use the Energy Saving Trust's Enhanced Construction Details, or alternatively the assessment of bespoke constructions to a similar or better standard using IP1/06. For further information on Enhanced Construction Details, please see the Energy Saving Trust website.

Y-Values

A Y-Value is an additional rate heat loss from a property. They are expressed in the same units as U-Values so can be added together in SAP to determine the total heat loss.

For example, if a U Value of an element was 0.30W/m^2K and an ACD detail was used, the contribution to the heat loss would be the Y-Value associated with using an ACD: 0.08W/m^2K. The total rate of heat loss would therefore be 0.38W/m^2K.

To determine both the DER and the FEE the Y-Value is needed to be used in the SAP / BREAM calculation.

1. Dwelling Emission Rate

The DER is derived from the U-Values through the building envelope and the Y-Value through the thermal bridges. Reducing the thermal bridges is therefore vital to gaining a high Code rating.

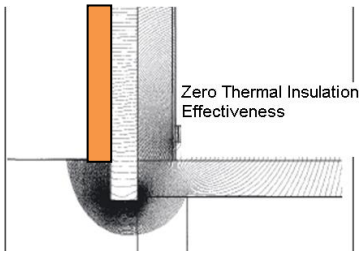
A Y-Value of no more than 0.04W/m^2K is recommended for Code 4 that will give about a 25% DER reduction. It can usually be achieved using enhanced construction details but not guaranteed. Using Marmox Thermoblock would give a much lower Y-Value, typically below 0.01Wm^2K. Thermoblock will give a much better DER than is actually required for Code 4.

2. Fabric Energy Efficiency

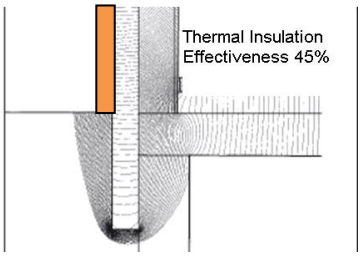
Performance targets determined by the Zero Carbon Hub within FEES include a target Y-Value of between 0.04 to 0.05W/m^2K to ensure that the seven Ene2 points are accrued NECESSARY for Codes 5 and 6.

There are two methods to achieve this degree of insulation at the wall floor junction; using either Enhanced Construction Details or Using a Thermal Insulation Wall footing block such as Marmox Thermoblock.

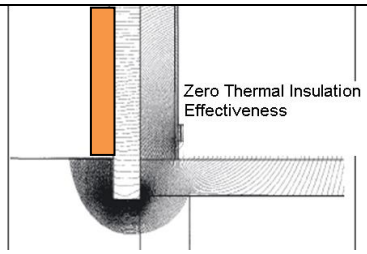
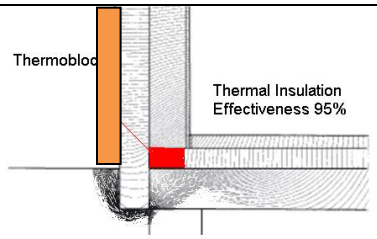
The common method employed in these details is to **extend the insulation within the cavity wall down past the height of the floor by at least 400mm**. The dark area in the first diagram shows the heat loss around a piece of insulation behind the inner leaf of a wall.



In the second drawing, the insulation has been lowered by 40cm. This simply makes the passage of heat more difficult.



By using the models suggested by the EST, a y-value of 0.04 can be used in the SAP calculation.

	This investigation showed that by replacing the bottom block in an aerated concrete inner wall with Thermoblock, the heat loss at the thermal bridge was twice as good as the EST method.	

The Y Value for the wall/floor junction is calculated as the ψ value multiplied by the perimeter of the thermal bridge all divided by the total building envelope.

Advantages of Using Marmox Thermoblock

- Enhanced Construction Details are not always practical and in many situations such as where there is dampness **a much simpler solution is available**. Instead of insulating around the problem, the actual root of the problem itself, the junction of the wall and the floor can be insulated.
- Because the 6.5N Marmox Thermoblock can foot a **supporting wall** of up to two stories, it can simply replace the bottom layer of blocks or bricks in an inner (or outer) wall, or serve as a **footing for a wooden frame**.
- Providing a DER in excess of the baseline requirement allows for other more expensive point scoring elements of the Code (such as Renewables, Solar Panels etc.) to be removed from the plans. For example, it has been shown that reducing the Y-Value at the wall/floor junction is sufficient to eliminate the need for 3m2 of PV panels.