Insulating Walls & Floors of Stone Buildings

Background

As the deadline draws closer for the UK Government to reach its Kyoto carbon reduction targets of 80% by 2050 and with intermediate carbon reduction targets to be met sooner there has been much work performed on insulating the UK's existing housing stock. The reason for this is that approximately 27% of the UK's CO2 emissions comes from domestic dwellings and 22% from other buildings, with the main emissions coming from space heating. Insulating existing buildings can present a number of challenges. It is essential that suitable insulating materials are used for each given type of structure. Failure to use the correct materials can lead to a number of issues, in particular moisture damage and mould. One particular type of construction, which is notoriously difficult to insulate are solid masonry wall buildings. The main challenge with insulating stone buildings is to maintain a safe moisture balance in the external envelope.

Trapped Moisture

With solid stone building there is a complex moisture balance. Whereas modern cavity wall buildings are designed to repel moisture and facilitate drainage in the form of a designed cavity, in the case of solid masonry buildings moisture can enter the wall from outside via rain penetration and can enter the wall from indoors via the diffusion of moisture vapour. It is essential that any moisture entering the stonework can escape when the relative indoor and outdoor climate permits.

In order to minimise water ingress it is essential that the lime mortar pointing is in good condition, there is sufficient drainage at ground level and that the rainwater goods (drain pipes, guttering etc) are in good condition and are fit for purpose.

In order to allow moisture to harmlessly diffuse externally in the winter or internally in the summer, it is essential that the wall is not insulated externally or internally with materials which impede the drying cycle. Suitable insulation products need to be moisture vapour diffusion open and also have a certain degree of water capillarity (i.e. be able to absorb some moisture and wick it away from the wall, without being detrimentally affected). Prior to the installation of any insulation in an existing

Above, Diathonite Cork Lime Screed ready for final floor finish

Above, A solid robust floor is achieved with Diathonite Cork Lime Screed
Below, Diasen Thermactive Insulation applied to the walls

stone building it is essential to carry out a survey of the building to highlight any existing damp issues. It may also be useful to carry out a numerical condensation risk analysis of the wall (using software such as WUFI or DELPHIN to BS EN 15026) in order to fully understand the hygrothermal behaviour of the wall after insulation has been installed.

Thermal Mass

Stone buildings have a high thermal mass, which means that they protect the indoors from over-heating in the summer and have the capacity to store heat for prolonged periods once heated. Thermal mass is a function of a material's specific heat capacity and density. The higher the specific heat capacity and density of a material then the higher the overall thermal mass. The use of insulating materials with a high density combined with a moderate specific heat capacity can further enhance the thermal mass of the building envelope, especially in the ground floor.

Combining Moisture Balance with Enhanced Thermal Performance

One group of insulation products, which are moisture vapour diffusion open and have a reasonable degree of water capillarity, whilst at the same time have excellent thermal insulation values are cork lime insulating plasters. Diathonite Thermactive is a thermal insulating plaster which is comprised of natural hydraulic lime (NHL-5), cork, lightweight silica and volcanic ash. The

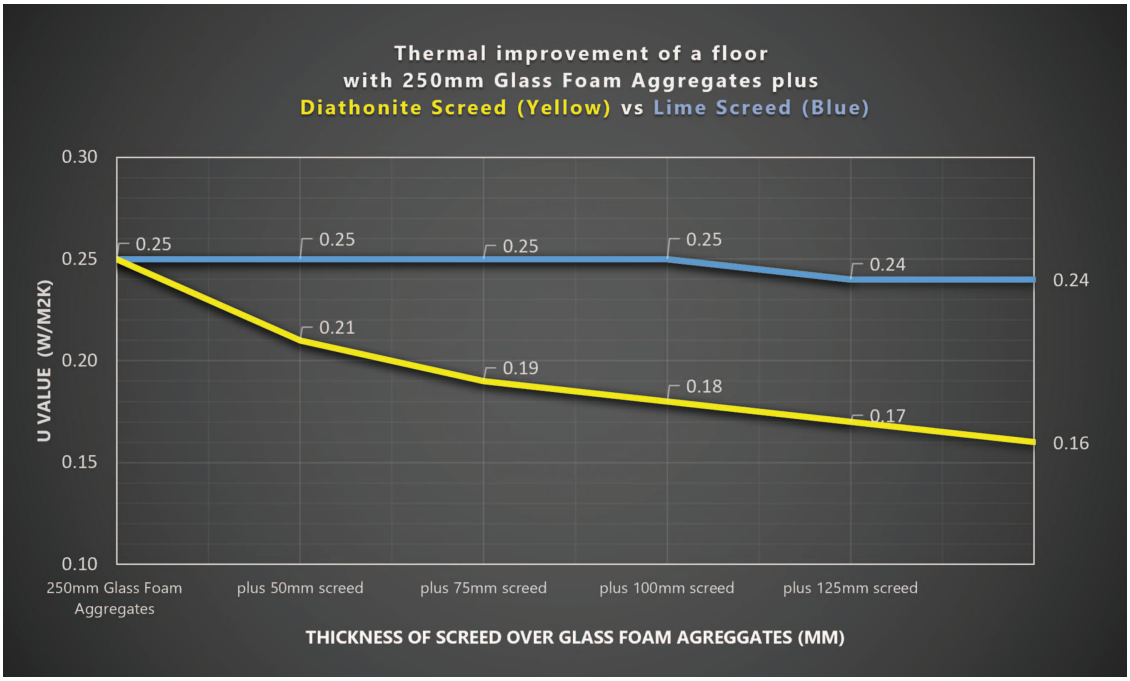
product has a lambda value of 0.037W/mK, is moisture vapour diffusion open (mu = 3), has a high degree of porosity and elasticity, is mould resistant and has a Euro Fire Class A1 rating. Diathonite Thermactive can be applied internally or externally.

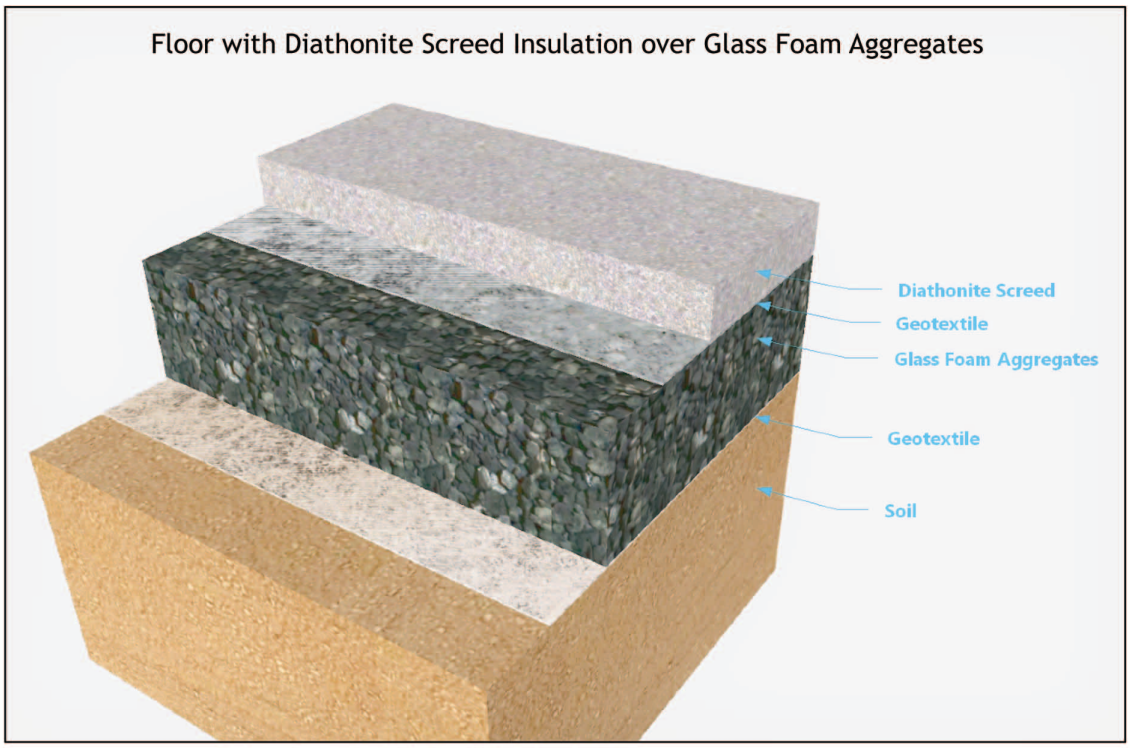
Insulating Stone Building Ground Floors

In many cases there are limitations as to the thickness of insulation that can be applied to stone walls. External insulation is often prohibited by planning rules (retain the original features of a building). Internal wall insulation thickness is often restricted by limited internal space, cost and other limitations such as an aesthetic need to avoid deep window reveals etc.

One area, where restrictions in wall insulation thickness can be partially compensated is by insulating the ground floor. Diathonite screed is a thermal insulating screed consisting of cork lime (NHL-3.5), cork, clay, diatomaceous earth and binding agents. The product is moisture vapour diffusion open (mu = 4), has a lambda value of 0.060W/mK, a specific heat capacity of 1000J/kgK, combined with a high density of 800kg/m3 and a compression resistance of >5N/mm2, with very fast drying time (up to 66% faster than typical cement or lime based screeds).

Diathonite Cork Lime Screed can be used internally or externally onto ground floor slabs, floors of non-heated rooms suspended slabs and terraces.





Thermal Improvement of a Floor

A converted corn mill in Cumbria has recently applied Cork Lime Screed to the floor. The existing lime and sandstone rubble walls were approximately 550-750mm thick. The clients wished to improve the thermal insulation of the existing concrete floor, which was approximately 100mm thick with a U value of 0.65 W/m2K, but also wanted to have a robust and solid finish as the room had been prone to flooding in the past.

The floor was insulated using 50mm thickness Diathonite Cork Lime Screed. Prior to the screed being fitted the external wall/floor junction was treated with Diasen Watstop, a three component epoxy resin tanking system, which creates an effective barrier against rising damp and avoids any humidity related issues. Some areas of the wall in the property are below ground and had salt issues so this again was a consideration for installing Watstop.

The area where there was a deeper void (an existing staircase was taken out) was filled with aerated glass foam granulate insulation before applying the Diathonite Screed. Adding 50mm of Diathonite Cork Lime Screed improved the U value to U= 0.41 W/m2K, in the area where a depth of 250mm of aerated glass foam was added, it improved the U value to a staggering U= 0.21 W/m2K! The chart above shows the U values that can be achieved using this system in comparison to lime screed.

Diathonite screed has helped to maintain a constant temperature even when the heating is turned off and this temperature uniformity has created a feeling of thermal comfort internally.

Above, 50mm of Diathonite Cork Lime Screed was applied to the existing concrete floor

This article focusses on the insulated floor substrate, ready for the final floor finish e.g. tiling, hardwood flooring etc.

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