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PROJECT

Wood Fibre Insulation

Specification Guidance for Social Housing

Cefnogrir y prosiect hwn gan Gronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig
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SPECIFICATION GUIDANCE

This document provides information for specifiers and procurement specialists working on social housing projects. It is designed to help with the specification of wood fibre insulation within a social housing context. It provides performance criteria and indicates what needs to be considered when specifying woodfibre insulation. Insulation is an essential element of the building fabric and should not be specified in isolation from the rest of the building design. This is particularly relevant to the specification of woodfibre based insulation materials which can provide important additional functionality and should therefore be a key consideration very early in the design process.

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WHY SPECIFY WOODFIBRE INSULATION?

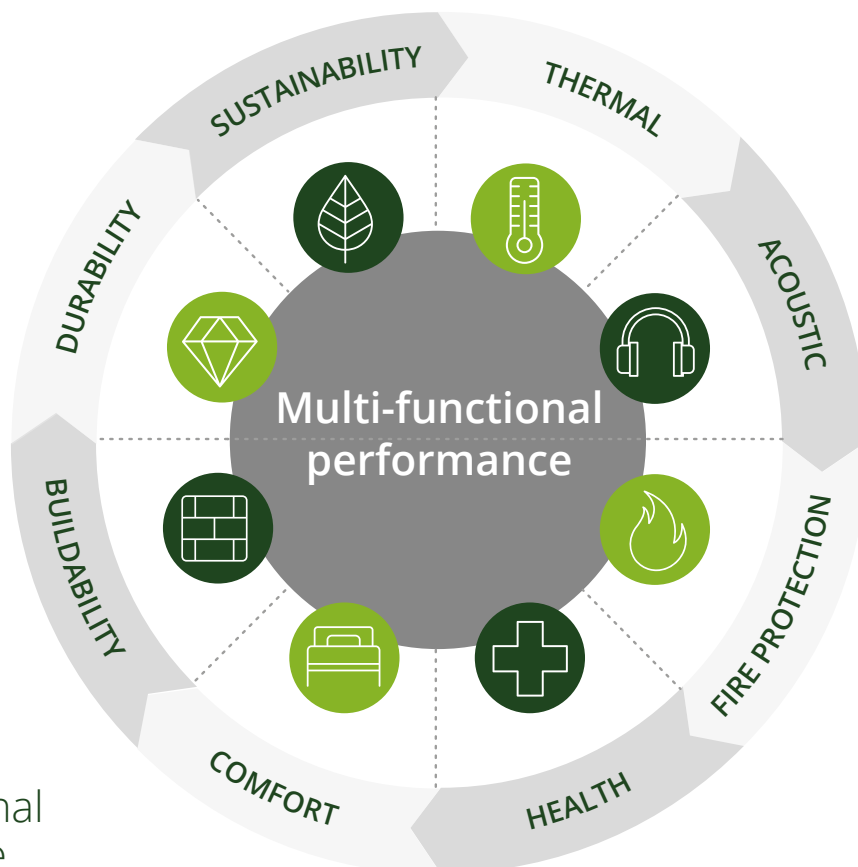
A building's thermal performance is now as important an aspect of the building's design and construction as its structure. Energy prices and climate change are often cited as the principal reasons for the increased energy and CO₂ reduction standards required of our built environment. Less known is the fact that insulation can also play a major role in our health, safety, comfort and wellbeing.

When higher levels of thermal performance are required, this has a significant impact on building physics and other dynamic elements of a building's performance. All insulation products now have to deliver multifunctional performance as shown in the diagram.

Woodfibre insulation has a number of properties that enables it to provide a multifunctional role within the construction of a home. When specified and installed correctly, woodfibre provides protection against summertime overheating, enhanced acoustic performance and moisture control. The latter provides a building fabric with additional insurance against potential moisture problems that could otherwise undermine the integrity of the building and the health of the occupants.

Woodfibre is highly sustainable, locking up considerably more CO₂ than is produced in manufacture. It can therefore play an essential part of a strategy for mitigating climate change.

Woodfibre insulation can be specified in new developments as well as retrofit projects.



Multifunctional
Performance

HOW TO SPECIFY WOOD FIBRE INSULATION

Insulation is an integral part of the building fabric. It should be considered early in the design process along with all other elements of your design. The chosen build system, construction process, manufacturer and site can all influence material selection and detailing.

We've listed a number of performance criteria to help you decide whether and what type of wood fibre insulation is the right choice for a particular project you're working on.

Types of wood fibre insulation

Woodfibre is typically manufactured using the green timber by-product from the sawmilling process. In a typical sawmill, the yield of sawn material (i.e. boards and planks) from a log is approximately 50%. The remainder of the log can be used for energy recovery or products such as Medium Density Fibreboard (MDF) or woodfibre insulation.

To manufacture woodfibre insulation the wood chip is heated, under pressure, and refined (or fiberised) to separate the individual wood fibres. The fibres are flash dried and then treated with binders or fire retardants, depending on the application, and dried ready for conversion into the finished product.



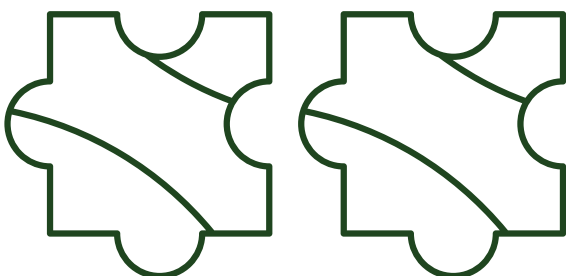
Loose fill insulation, typically for blowing into closed panels.



Flexible batt insulation, typically for compression fitting between studs and rafters and joists.



Semi-rigid insulation boards (produced with a square edge or tongue and groove profile) for use in multiple applications such as insulated sarking board and insulated cladding.



THERMAL PERFORMANCE

Woodfibre has a thermal conductivity (measured in lambda or λ) of between 0.038 and 0.042 (W/m.K), nearly identical to mineral wool. It can be installed 'traditionally', i.e., between studs, between rafters, or over ceiling joists. Alternatively, it can be used as a continual wrap around the building envelope, i.e., over studs, rafters masonry etc. which dramatically reduces thermal bridging.*

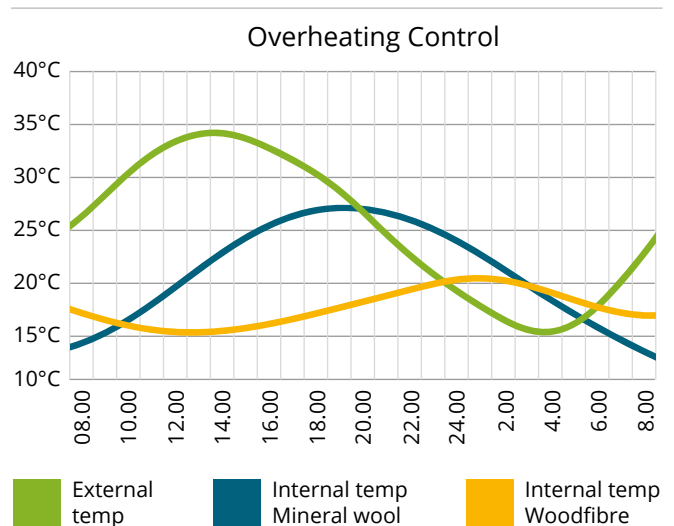
It can be used within clad and brick facades. Semi-rigid boards can also carry a render applied directly to its surface, providing simplified construction build ups.

OVERHEATING

The conductivity (lambda or λ) is often thought of as the only concern when choosing an insulation material. Insulation levels have a direct effect on the physics of a building. This is particularly noticeable in light weight structures or elements such as roofs, or in timber frame buildings, where solar radiation can quickly move through the building fabric. Once inside, the heat is trapped by the insulation leading to internal overheating.

The thermal mass in woodfibre contributes significantly to its overheating resistance. Woodfibre effectively locks-up the sun's heat during the day,

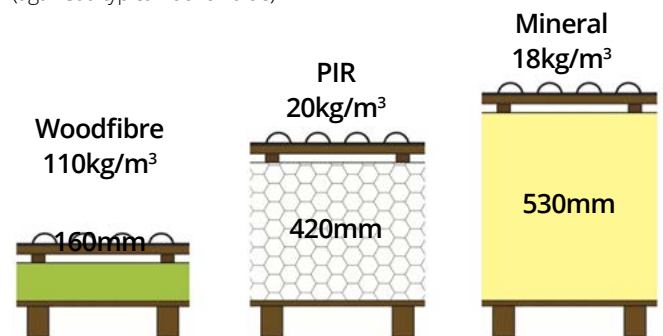
releasing it back into the cooler night sky, from late evening onwards. Some of the heat will still enter the building, but at a much later time and at a much lower temperature. This time lag between peak external temperature and peak internal temperature is called the decrement delay.



The graph shows the decrement delay of mineral wool vs woodfibre. This comparison can also be seen below showing the different material thicknesses required to deliver the same decrement delay.

Woodfibre has high thermal mass which reduces overheating by 8 hours

(against a typical roof u-value)



'Traditional' insulation requires far greater thickness of insulation to achieve the same reduction in summertime overheating

A frequent misconception is that insulation, installed to keep the heat within a building in the winter, will keep it out in the summer. This is not the case. The amount of energy required to keep a building warm in winter is very low by comparison to the amount of energy that a building receives from solar radiation on a summer day. In order to mitigate against internal overheating thermal mass - the ability of a material to absorb and store heat energy - is required.

* Thermal bridging occurs between the interface of building elements, such as roof to wall, wall to window, etc. It accounts for as much as 30% of heat loss when achieving a principal level of building regulation compliance.

FIRE PERFORMANCE

Domestic fires in homes present a serious hazard for the occupants. Key to delivering fire protection is to reduce the hazards caused from both the fire source and from the gases released by burning items. Through material selection, the intensity and resultant toxicity of a fire can be significantly controlled. Perhaps counter-intuitively, woodfibre insulation possesses essential qualities here.

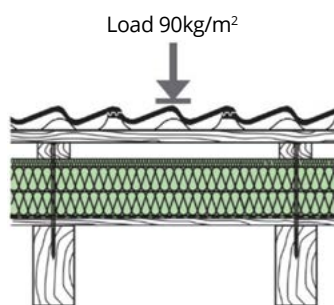
Combustible materials are often assumed to be more hazardous than non-combustible materials. This is not necessarily the case. In order to design a building where the occupants are as safe as possible it is essential to understand not whether a material is combustible but how fire will behave within a given context. As a matter of fact, woodfibre fulfils the highest requirements for fire protection, as demonstrated across mainland Europe for decades.

Mitigating heat & oxygen

Oxygen, heat and fuel are the primary requirements for fire. While woodfibre must be accounted for as a fuel load in a building's design, its density mitigates against both heat and oxygen levels. As a result, the relatively high density of rigid woodfibre products significantly reduces the two primary hazards of fire - oxygen and heat.

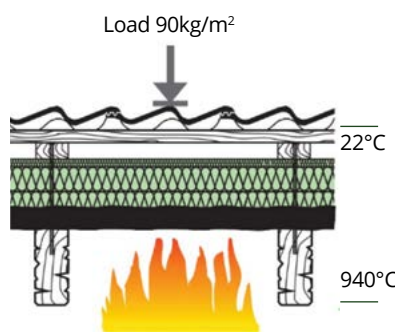
Ignition of neighbouring materials is one of the main mechanisms for the spread of fire through buildings and adjoining properties. Woodfibre has a very high heat capacity for an insulation material. In a fire it heats up much more slowly than other insulation materials. This high storage capacity of woodfibre insulation, almost completely prevents heat penetration as demonstrated in the temperature gradients during a fire. As a result, ignition of neighbouring materials, e.g. furnishing occurs much later than say for mineral-fibre based insulation which are classed as non-combustible.

Fire resistance in roof & wall build ups



Over-rafter insulation made from PAVATHERM and PAVATHERM-PLUS

Test set-up from outside to inside:
Roof cladding
Tile battens



Component and condition temperatures after a 50 minute test

The wooden beams were sized to comply with DIN-4102-4 for REI 45 but retained their load-bearing capacity through the entire duration of the test.

Woodfibre can be exploited in roof and wall build ups to provide very high levels of fire resistance. When woodfibre insulation is exposed to fire an ash layer forms on the surface of the insulation boards. The carbonised surface hinders oxygen feed-in, preventing the rapid spread of the fire. Please note: This is currently not standard practice in the UK.

Example: In a roof the temperature at the fire source reaches up to 940°C, while the temperature on the upper surface of the roof remains at just 18°C over a 45min period.

Whole Building Approach

When designing for fire safety, it is important to consider resistance to fire for a whole building system that protects a load bearing structure such as a roof, or wall etc. The European rating (REI) considers the following factors:

- R – Load bearing capacity. To maintain load bearing without the loss of structural capability.
- E – Integrity. To withstand fire exposure, in general from below to above, without fire passage through to the other side in the form of flames.
- I – Insulation. To withstand fire exposure, on one side only, without the transmission of fire in the form of significant heat transfer.

An REI 30 means that the whole system will not collapse within 30 minutes. PUR Roof panels typically have REI 15. An equivalent woodfibre panel (in terms of thermal performance) will have a fire resistance class of REI 45, with other woodfibre based building systems delivering REI 90. As a combustible material woodfibre insulation products typically have a fire rating of Euroclass E (EN 13501-1).

Minimising toxicity

A further important advantage of woodfibre insulation is its minimal release of hazardous gases into the air. Many synthetic insulation materials can omit toxicity levels over six times higher than woodfibre insulation. In the event of a fire these toxicity levels create additional hazards including greatly reduced visibility within a building.

MOISTURE CONTROL

Moisture plays a significant role in the performance of a building as well as the health and wellbeing of the occupants. Moisture control is likely the most complex dynamic within building physics and requires special attention. Specifiers need to ensure that the building fabric is designed to regulate moisture at safe levels for the health of occupants and for the durability of the fabric.

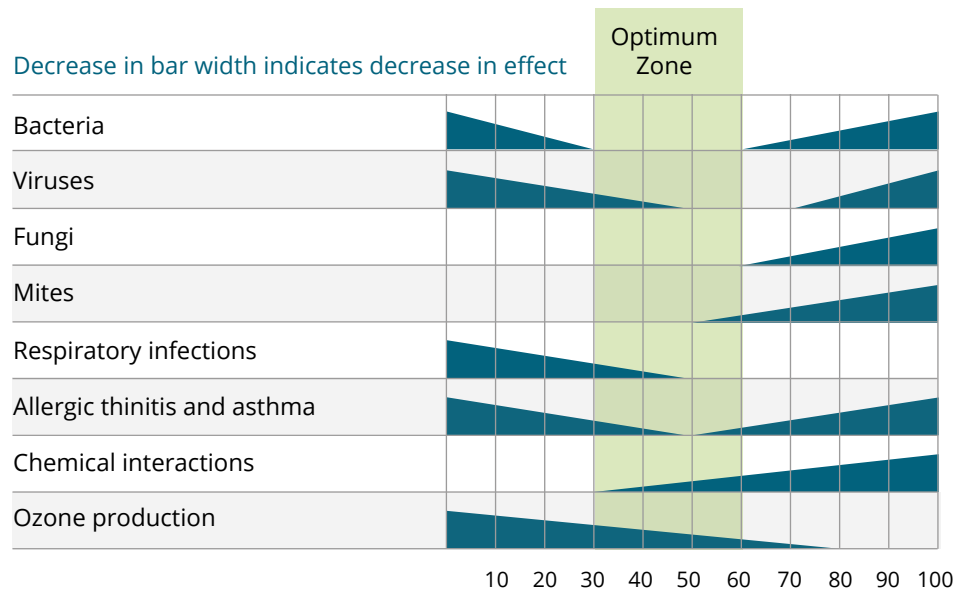
Moisture as vapour constantly moves through the building fabric during the winter months. First as heat from the inside of a building, it then transitions through the fabric to the colder external environment, carrying moisture vapour with it. Materials used within the building fabric need to be able to manage this moisture at levels that ensure the fabric is not compromised (see box on next page).

Rain falling on the external surfaces of the building can be driven into the fabric through solar radiation from springtime onwards. As a consequence, materials in the building envelope also need to be able to buffer, wick and disperse moisture, in both liquid and gaseous forms, ensuring that moisture can get out of the fabric more quickly than it got in.



Impact of Relative Humidity

Relative Humidity [RH] has an impact on elements such as bacteria, fungi and mites as the graph shows.



Depending on type and species, the listed elements are unable to proliferate at around 50% RH. Incidentally, this is where humans tend to be most comfortable.

Most of these elements are airborne and therefore need to be regulated by an effective ventilation strategy. Some, including fungi/mould and chemical interactions can occur within the building fabric. Not regulating RH levels and liquid moisture risks compromising the integrity of the building fabric.

Vapour control layers (VCLs) and cementitious based products are standard choices to keep the moisture out. However, even very small openings in a membrane or fabric will lead to a significant amount of moisture entering the fabric of the building. Over time, often years, this can lead to fabric decay, or present as a significant health risk to the occupants.

Due to its capillarity, hygroscopicity and vapour openness, woodfibre allows the building fabric to dry out thus ensuring its integrity. This is particularly important in retrofit solutions where many insulation products and systems have limited compatibility with the existing fabric, such as solid masonry walls.

It is essential to ensure that moisture control is understood by those responsible for specifying insulation.

Capillarity. Rise or depression of a liquid in a small passage, like the openings in a porous material.

Hygroscopicity. Absorbing or attracting moisture from the air and releasing it back into the air. Also the rate to which it can do both.

Vapour openness. Breathability of a fabric.

ACOUSTIC PERFORMANCE

A lesser known aspect of woodfibre is its high acoustic performance. Lightweight buildings and rooms in roofs are known for their poor acoustic performance with street and other external noise pollution often being heard. Woodfibre insulation significantly reduces unwanted noise to well below normal regulatory requirements.

INSTALLATION

Woodfibre is by no means a challenging product to understand, or to install. Typically it is fitted by those with joinery skills, who often favour fitting woodfibre over other insulation materials.

A principal understanding of how to handle, cut, fit and fix the product, and ancillary components, is important. Other trades, such as plasterers need to be clear on how to apply additional product to the woodfibre.

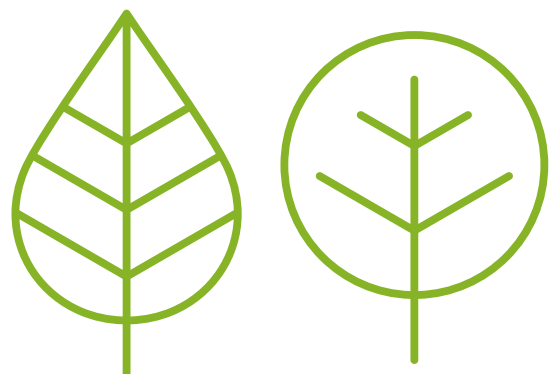
As with all methods of construction training is essential. Most woodfibre suppliers in the UK provide training and advice.

MAINTENANCE

Once installed, woodfibre insulation is maintenance free. If installed correctly it will last the lifetime of the building as attested to by numerous certification bodies such as the BBA.

END OF LIFE

Woodfibre can be re-used, recycled, composted, or used as renewable fuel at the end of life. With a growing need to ensure global resources are managed within a circular economy, the use of woodfibre provides a marked alternative to the take-make-waste model of other insulation options.



SPECIFICATION

Woodfibre insulation can be specified in both new developments and retrofit projects. It is a highly effective insulation material with multiple applications in a range of construction types. It stores more carbon than is required for its production which makes it suitable for housing stock fit for a zero-carbon future. There is no scientific reason why woodfibre should not be considered as an appropriate insulation solution for the vast majority of new build and retrofit schemes.



Roof Insulation

Cold Roof

Both loose fill woodfibre and woodfibre flexible batts are suitable for insulating a cold roof. Maintaining ventilation at the eaves or through tile vents at low level is essential for all insulation materials.

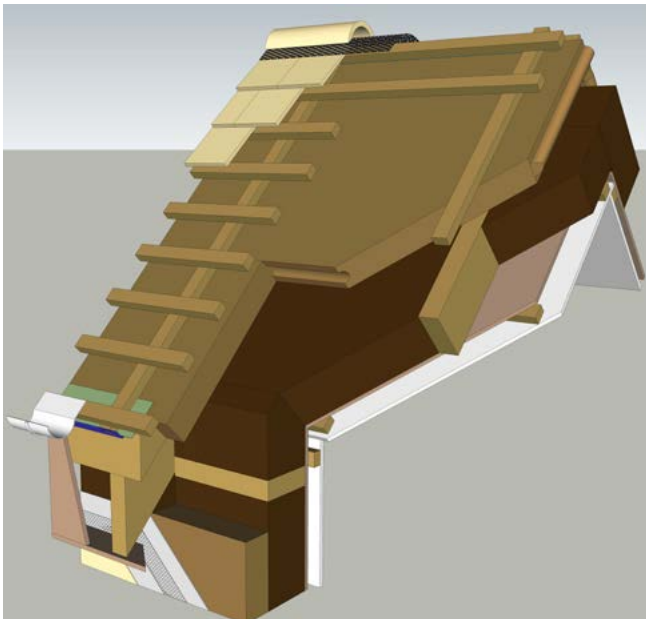
Woodfibre flex batts can be more expensive than similar insulation materials and the need to deliver moisture control and overheating control are at their least critical here.

Loose fill woodfibre is far more competitive, but is not as readily available within the UK.



Image courtesy of
[First in Architecture](#)

Warm Roof

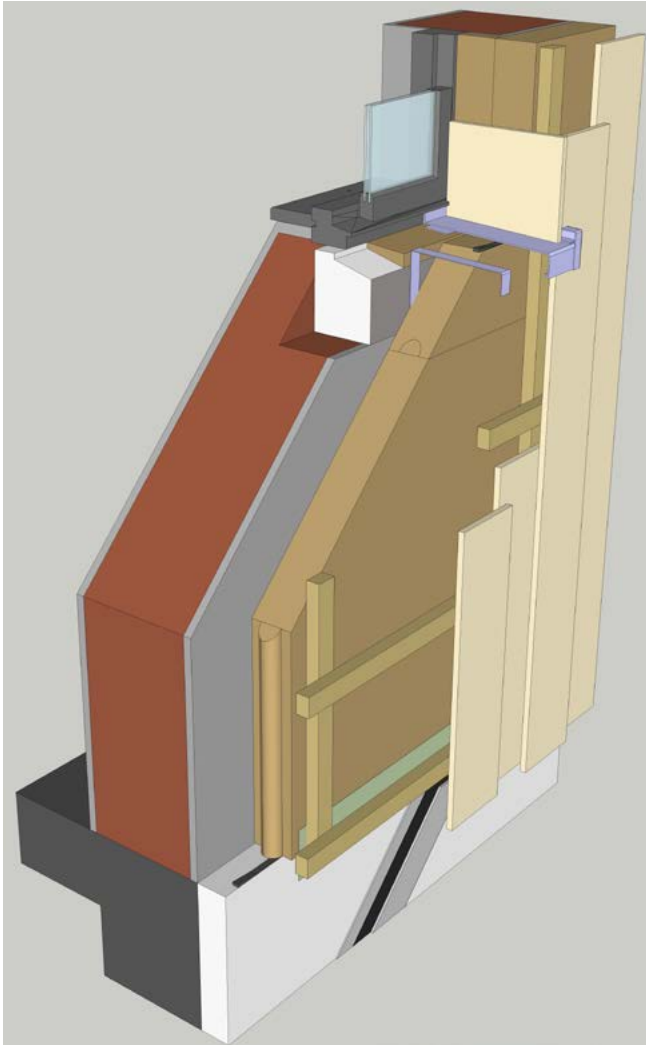


A combination of flexible woodfibre insulation placed between the rafters and semi-rigid board placed over the rafters provides a highly effective solution. It delivers thermal comfort all year round and mitigates overheating in addition to providing a failsafe solution against moisture build up. It also provides acoustic insulation.

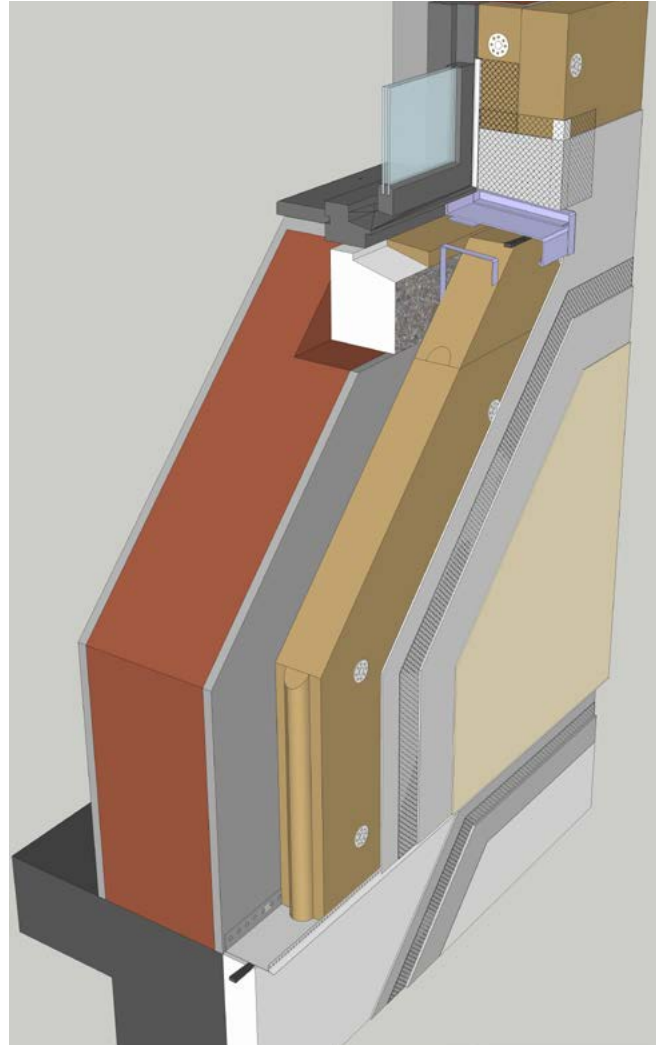
When applied over the rafters, semi-rigid boards exploit a tongue and groove profile providing wind tightness and resistance from driving rain. No outer membrane is required.

Masonry Wall

External wall insulation (EWI)



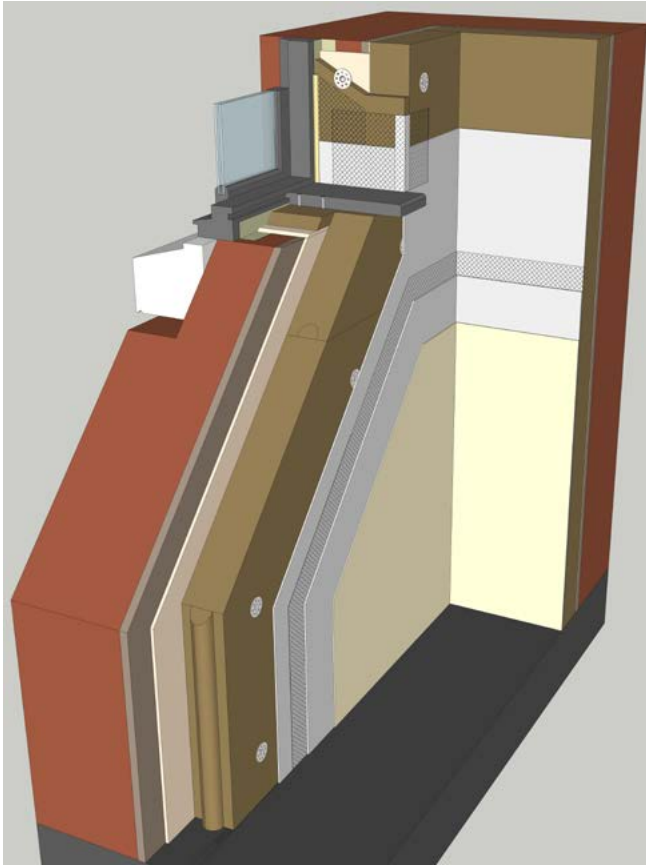
Woodfibre insulation can be applied to either a new block wall or an existing masonry wall. With a new block wall, the use of woodfibre speeds up the release of construction moisture from mortars and internal plasters, thus reducing the drying out time. Construction moisture, causing mould problems, is getting more commonplace in new builds due to the increased success of delivering higher levels of air tightness.



In both new build and retrofit the woodfibre board is fastened directly to the masonry with thermally broken fixings. It can be used with cladding or can directly carry a rendered finish eliminating the need for membrane, batten, and render carrier board. Both systems are failsafe for moisture control and have received BBA certification. They are suitable for all exposure zones 1-4 across the UK.

Masonry Wall (cont.)

Internal Wall Insulation (IWI)



Internal wall insulation systems using woodfibre occupy a unique position within the IWI market. They offer the lowest risk in terms of moisture control and fire issues, the health of the occupants and the integrity of the building fabric. Woodfibre's ability to wick and buffer moisture plays a key role here.

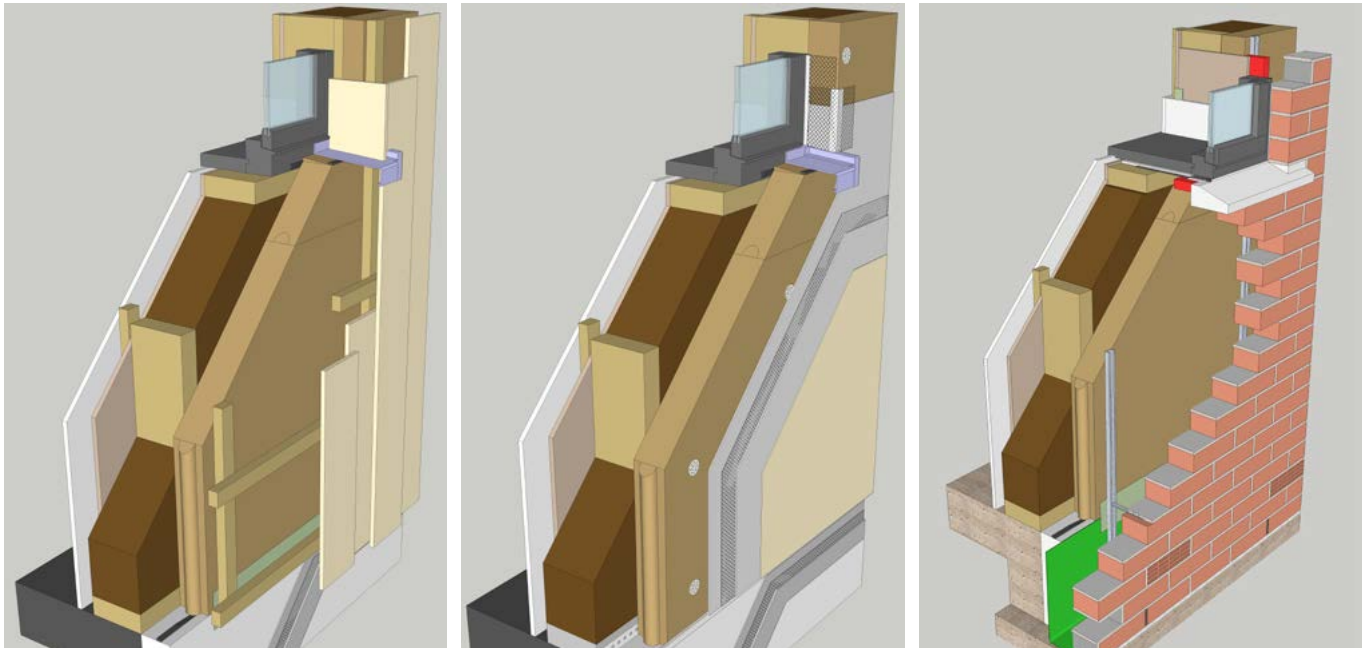
Within an IWI system, full bonding of the insulation to the existing wall, moisture distribution and vapour control are essential components to ensure effective moisture control. Woodfibre provides all of these functions.

The system uses the semi-rigid insulation which is bonded to the existing wall, with a lime based adhesive and mechanically fastened, if needed, back to the wall with thermally broken fixings. The woodfibre board is then either plastered directly, or covered with an airtightness membrane, battened out (for services), plaster boarded and skimmed. Just 40mm of woodfibre will deliver approximately a 70% reduction in heat loss when applied to a solid brick Victorian wall.



Timber Frame

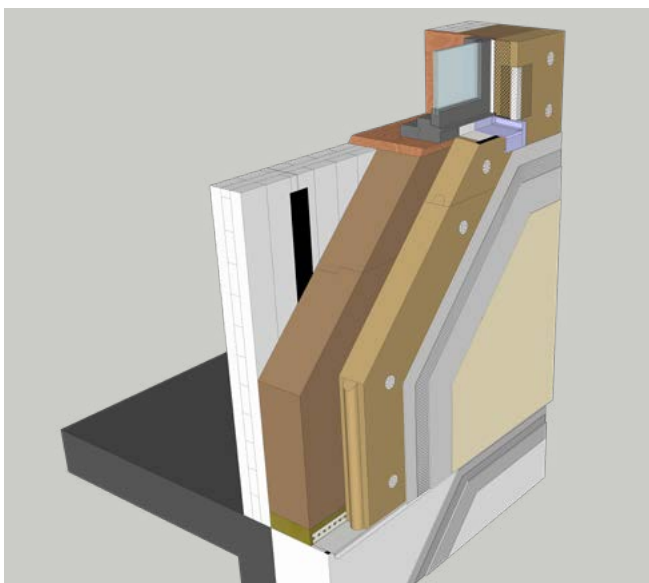
Internal Wall Insulation (IWI)



The structure is internally fitted with flexible woodfibre insulation between the studs and externally fitted with semi-rigid woodfibre boards. The tongue and groove profile of the semi-rigid board allows a continuous wind tight wrap around the structure which significantly reduces thermal bridging created by the timber frame elements.

The moisture control benefits of woodfibre are so effective that, with the exception of the floor plate, untreated timber could be used within the timber frame, reducing cost and chemical use.

Mass timber, SIPs and lightweight steel



Modern methods of construction (MMC) evolved considerably over the past decade including the use of advanced timber-based products such as Laminated Veneer Lumber (LVL) and Cross Laminated Timber (CLT). As with timber frame construction, careful attention must be given to moisture control to avoid the risk of decay. The use of woodfibre mitigates this risk altogether, thus providing a build solution that stores significant amounts of carbon.

Further examples of construction types that use woodfibre insulation include steel frame and structural insulated panels (SIPs).

TECHNICAL INFORMATION

ASBP Technical Briefing Papers

- The Multiple Roles of Insulation
- The Health & Well-Being Benefits of Insulation
- An Introduction to Breathability
- Airtightness, Vapour Control and Breathability

EXAMPLES

Find examples for use of woodfibre insulation in social housing across Wales [here](#).

GUIDANCE FOR SOCIAL HOUSING

Check out our range of guidance documents for specifiers and developers in Social Housing [here](#).



Images in this document have been kindly provided by Steico, Soprema, First in Architecture and Woodknowledge Wales.