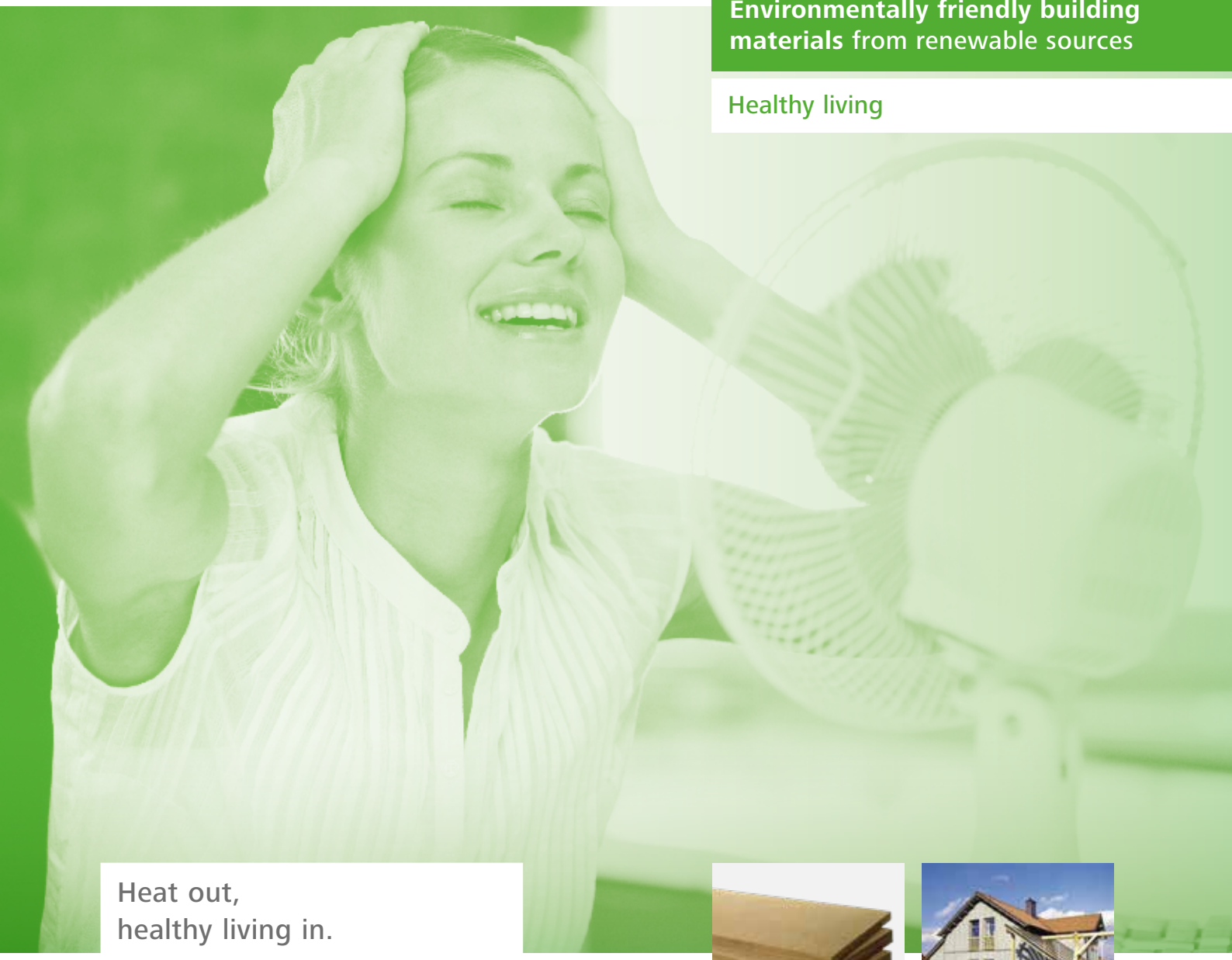
Summer Heat **Protection**

Environmentally friendly building materials from renewable sources

Healthy living



Heat out, healthy living in.

How STEICO insulations can help you enjoy hot summer days inside, without the need for additional ventilation or air-conditioning.

STEICO
engineered by nature

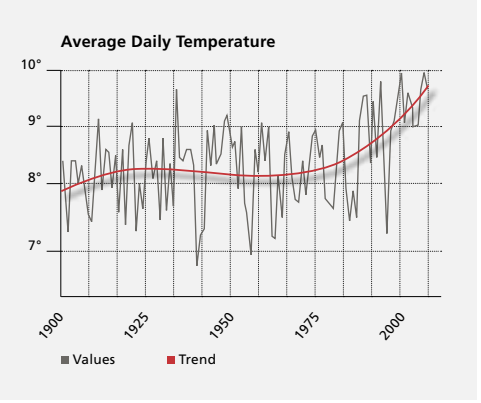
Summer heat protection

Healthy living under extreme conditions

As nice as the summer is: we all feel uncomfortable at tropical internal temperatures. STEICO insulations ensure that on hot days the internal climate of your home remains comfortable – without expensive air-conditioning.

Our climate is changing, that is certain. The number of so called “tropical days” with temperatures over 30 °C, have quadrupled in the past 2 decades. It’s understandable therefore, that new builds and renovations are increasingly including for summer heat protection. After all, who wants to live in Sauna like temperatures? With specialist construction and informed material choice it is possible to create a healthy and comfortable indoor climate – in a totally natural way.

An important starting point should be to address the fabric of the building, namely the walls and roofs. This is where STEICO insulations can make sure that the heat stays out – especially in attic rooms.



On a global scale more energy is used keeping buildings cool than there is used on heating them. The solution can be so simple. With natural wood fibre insulations from STEICO you can save on an expensive air-conditioning unit as well as saving on heating costs in the winter.

Suitable all year round
STEICO insulations save energy and heating costs in winter. The same insulations prevent overheating in summer. Noise is also absorbed effectively.

Thermal diffusivity: The key to summer heat protection

Attic rooms are particularly susceptible to increased temperatures in the summer months. This is due, not only to unsuitable insulations, but often to a low thermal storage capacity of the building structure. In simple terms: Most constructions cannot resist the influx of heat during the summer months. The heat has a more or less unhindered path into the building.

The solution is to utilise building materials with a high thermal storage capacity – such as STEICO insulations. In the hot midday and early afternoon hours they absorb the heat and act as a "buffer" delaying the heats progress. If this heat is stored and released over a specific time frame it can become a positive heat influx in the cooler evening temperatures.

There are also additional measures that can improve summer heat protection: Shuttering of window areas or a different air circulation method can make a difference. Together with the high thermal storage capacity of STEICO insulations even attic rooms can have a healthy and comfortable climate.

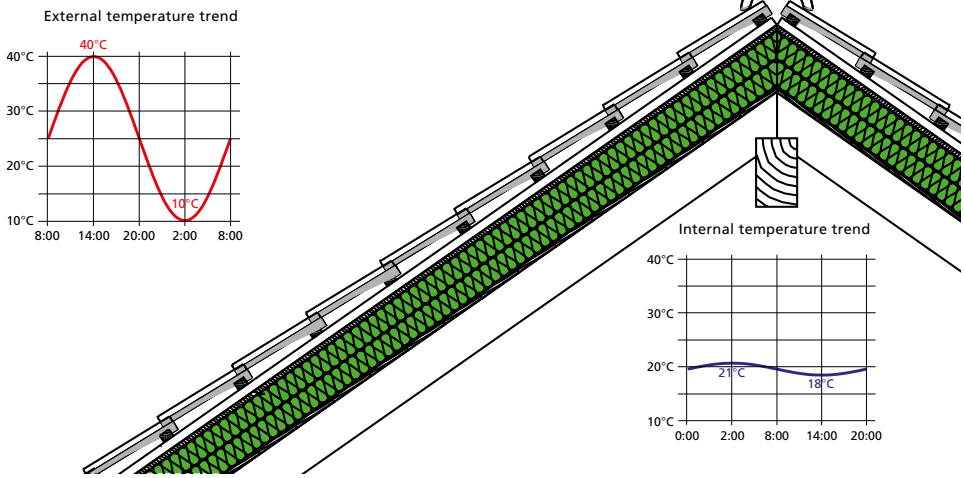
The correct choice of insulation is vital to the effectiveness of a particular construction. Essential for effective summer heat protection are insulations which show a very slow temperature transfer time, or put another way, as low as possible thermal diffusivity. As well as offering high thermal insulation, these are materials that offer a low thermal conductivity as well as a high density and high specific heat capacity. Denser materials such as steel for example, are poor insulators as they have a high thermal conductivity. STEICO insulations have an ideal ratio of low thermal conductivity and a combination of high density and high specific heat capacity and therefore produce a very low thermal diffusivity.

$$\text{Thermal diffusivity } a = \frac{\text{Thermal conductivity } \lambda}{\text{Density } \rho \times \text{Specific heat capacity } c} \quad \frac{cm^2}{h}$$

Material	Density [kg/m³]	Thermal conductivity [W/(m*K)]	Specific heat capacity J/(kg*K)]	Thermal diffusivity a cm²/h
Spruce, pine, fir	600	0.13	2500	3
STEICO*universal* sarking and sheathing board	270	0.048	2100	3
STEICO*protect H* external thermal insulation	265	0.048	2100	3
STEICO*special dry* renovation boards	140	0.040	2100	5
STEICO*therm* rigid insulation	160	0.038	2100	4
STEICO*top* insulation for attic floors	140	0.040	2100	5
STEICO*flex* flexible insulation from wood	50	0.038	2100	13
Brickwork	1800	0.8	1000	16
Reinforced concrete	2200	1.4	1050	22
Polystyrene	40	0.040	1380	26
Polyurethane foam	30	0.030	1380	26
Glaswool	30	0.035	800	53
Steel	7800	58	600	446
Aluminium	2700	200	921	2895

Amplitude dampening and phase shifting

Example of a roof construction with an amplitude dampening of 10 and a phaseshift of 12 hrs.

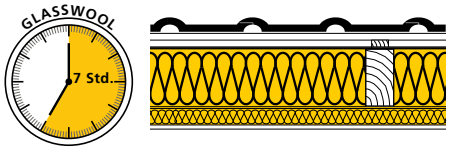


Amplitude dampening and Phase shifting are as vital for summer heat protection as the U value is for thermal insulation in winter. Amplitude dampening shows the strength with which the temperature penetration is reduced. The phase shift shows, by how many hours, the penetration of the maximum temperature is delayed.

Amplitude dampening (1/TAV) is based on the relationship of fluctuations between the external and internal temperatures. For example if the outside temperature fluctuates between 10 and 40 °C and the inside temperature fluctuates between 18 and 21 °C then the external change is 30K (Kelvin) and the internal change is 3K. The relationship of amplitude dampening in this instance is therefore 10 (= 30 K / 3 K).
In other words the temperature fluctuation through the fabric of the building has been dampened from the external to internal side by a factor of 10.

Phase shifting is the time span between the highest external temperature and the highest internal temperature. In the above example this is the 12 hours between 14:00 hrs and 02:00 hrs. The aim of summer heat protection is to delay the heat transfer through the fabric of the building so that the high midday temperatures only reach the internal side when it is already cooler outside and hence reduce the need for additional artificial heating during those periods. In ideal circumstances a phase shift value of 10 hrs should try to be achieved. A portion of the stored thermal energy of the building fabric is then automatically transferred to the external side. This ensures that the internal temperature fluctuations are much less than those on the external side.

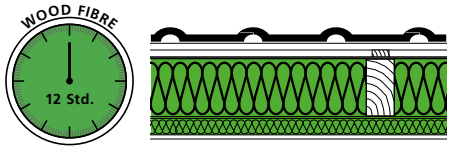
Roof construction comparisons
Roof 1 with mineral fibre insulation



- **U = 0,17 W/m²*K**
- **1/TAV = 6**
- **Phase shift = 7 hrs**

- **Tiles**
- **Tile batten**
- **Counter batten**
- **Felt**
- **Mineral fibre 200 mm**
- **Vapour barrier**
- **Mineral fibre 40 mm**
- **Plasterboard 12 mm**

Roof 2 with wood fibre insulation STEICO*flex*



- **U = 0,18 W/m²*K**
- **1/TAV = 12**
- **Phase shift = 12 hrs**

- **Tiles**
- **Tile batten**
- **Counter batten**
- **Felt**
- **STEICO*flex* 200 mm**
- **Vapour barrier**
- **STEICO*flex* 40 mm**
- **Plasterboard 12 mm**

The facts explained

It is particularly important to consider Amplitude Dampening and Phase Shift in roof areas. The ratio of external surface to room volume is very high, so Attic Rooms have a high area for potential temperature transfer.

The areas directly under the roof coverings can get very hot in summer (up to 80 °C) and this leads to increased heat in the rooms below. As many roof constructions have a very low thermal storage mass, they are particularly suitable for the installation of natural insulations from STEICO.

With the exception of the roof cladding and the internal plasterboard the thermal mass of the roof construction is entirely reliant on the insulation. It is therefore vital for Amplitude Dampening and Phase Shift that insulation with a low thermal diffusivity is utilised.

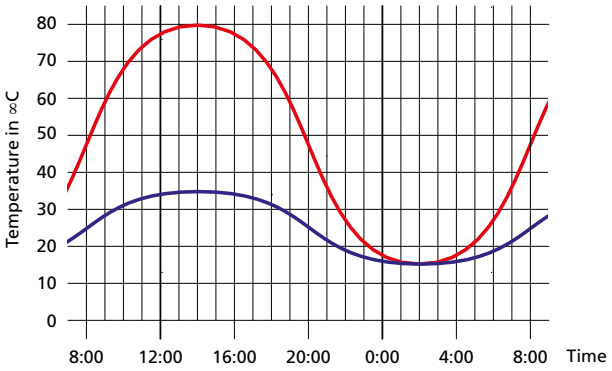
Ideally an Amplitude Dampening value of 10 (TAV 10 %) and a minimum Phase Shift value of 10hrs is what should be achieved. With an external temperature of 35 °C and a possible temperature under the roof covering of 80 °C, it is important to ensure that the influence this temperature has on the internal climate is delayed through Amplitude Dampening and Phase Shifting.

In these hot summer conditions you can get very different results using various insulation materials. If you compare 2 roofs, which both have a U value of 0.18 W/(m²*K), utilising mineral wool with a thermal conductivity of 0.035 and a density 20 kg/m³ you achieve an Amplitude Dampening of 6 and a Phase Shift of 6.8 hrs. This results in an internal temperature under the roof of 29 °C at 20:00 hrs.

This is considered far too hot for comfortable sleeping conditions. The external temperature at this time is also 29 °C so there is no rest bite if you try to cool the room by opening the windows.

If you swap the mineral fibre for STEICO*flex* wood fibre insulation the situation changes dramatically. The insulations have the same thermal conductivity but a density of 50 kg/m³ which increases the thermal storage mass by 5 times, due to its improved thermal storage capacity. In this scenario the Amplitude Dampening rises to 12 and the Phase Shift to 11:00 hrs. This results in an internal temperature of only 21 °C at 01:00 hrs. If this is still too uncomfortable then opening the windows will cool the building as the external temperature at that time is only 15 °C.

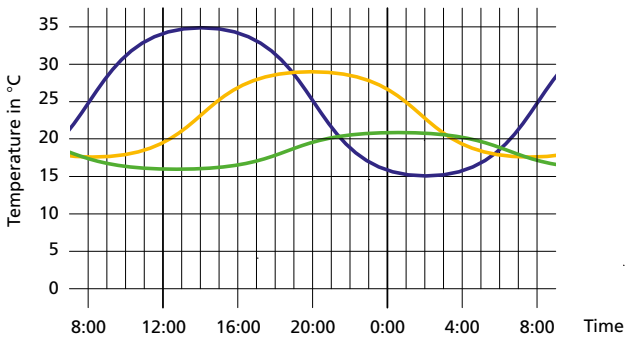
Daily temperature profile



Temperature under the roof covering
External temperature

With an external temperature fluctuation between 35 °C at 14:00 hrs and 15 °C at 02:00 hrs the temperature under the roof covering can reach 80 °C, reducing to a minimum of 15 °C at night.

Daily Temperature profile with various insulations

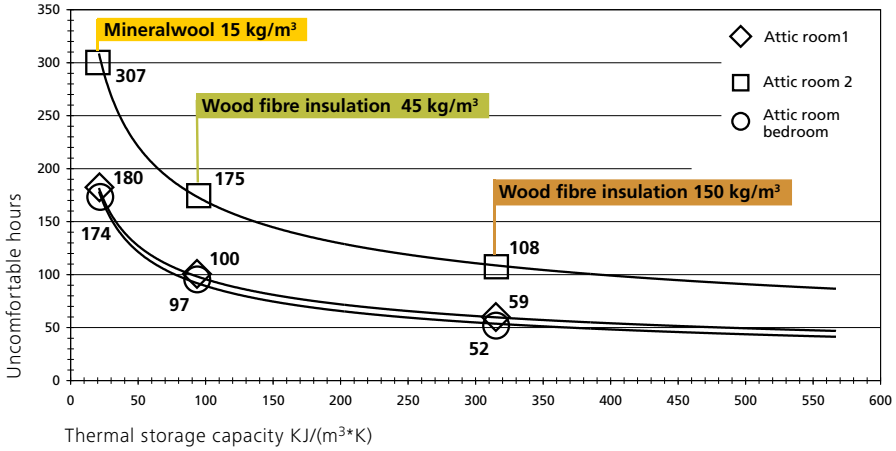


External Temperature
Internal room temperature with mineral wool
Internal room temperature with wood fibre insulation

With STEICO wood fibre insulations the highs and lows of temperature fluctuations are reduced, resulting in a comfortable and healthy internal climate all day long.

The facts don’t lie: STEICO works

That temperature behaves this way and has a direct influence on the comfort and health of internal climates is apparent in the research of Professor Hauser, one of the founding fathers of German energy efficiency. Using the example of a one bedroom house we are able to reduce the “uncomfortable hours” by swapping the mineral wool for wood fibre insulation by almost 50 %. To put it simply, one sweats a lot less. With the use of wood fibre sheathing boards with a density of 150 kg/m^3 the “uncomfortable hours” compared to mineral wool insulations can be reduced by 60 or even 75 %. The climate sensitive nature of STEICO wood fibre insulations ensure an efficient and cost effective solution both in winter and summer and help to maintain a comfortable and healthy environment.



The results speak for themselves: The higher the thermal storage capacity of an insulating material the better the results.
“Uncomfortable hours” – the time in which we feel uncomfortable on account of the heat. STEICO wood fibre insulations provide an excellent solution.

Summary

Heat protection in hindsight

What is, hopefully, taken as state of the art in new builds, is often difficult to incorporate in renovations. But, this is also an area that STEICO offers an excellent solution.

Roof renovation from outside

The ideal solution when the internal room finishes cannot be disturbed.

After the removal of the roof coverings, the rafter voids can be filled with a flexible insulation like STEICO*flex*. To maximize the efficiency of the construction a rigid insulation such as STEICO*special* can then be fixed on top, directly to the rafters. This board is hydrophobic and therefore offers 3 additional types of protection: additional rain protection, air tightness, and insulation.

Example:
With 160 mm STEICO*flex* and 60 mm STEICO*special*:

U value = 0.20 W/m²*K
Phase shift: 14,4 hrs

Roof renovation from inside

With this solution the weather tightness of the structure is not affected and there is no need for scaffolding.

Once the internal finishes are removed the rafter voids can be filled with STEICO*flex*. To maximize the insulation the rafters can then be cross battened and additional insulation can be incorporated. This void area can then also be utilized for additional services such as electric cables.

Example:
With a total of 160 mm STEICO*flex*:

U value = 0.24 W/m²*K
Phase shift: 9,8 hrs

Wall renovation

A long lasting external wall renovation with many benefits – including summer heat protection as an added bonus.

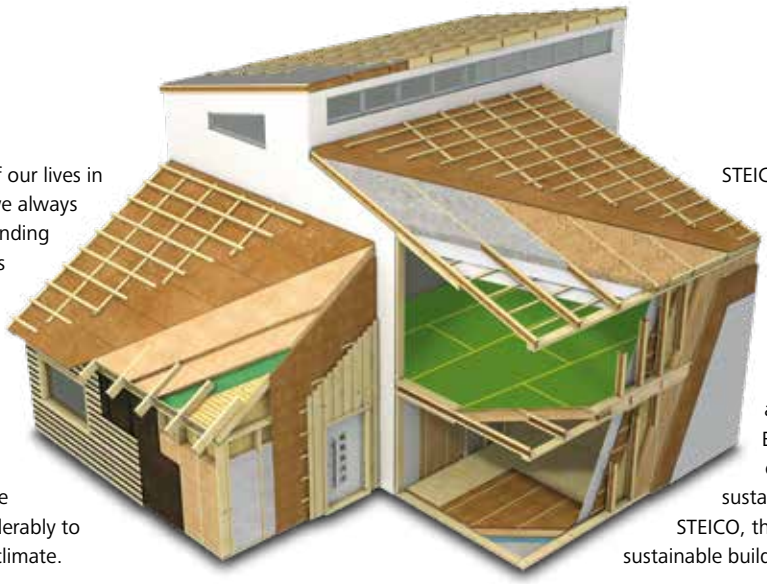
The main advantage over traditional polystyrene cladding systems: Thermal storage capacity actively assists the build up of algae on external surfaces. Using this system, building elevations cool down much slower during the night, so air moisture is much less likely to settle as condensation on the surface, thereby removing the habitat of algae.

Example:
With 100 mm STEICO*flex* and 60 mm STEICO*protect*:

U = 0.24 W/m²*K
Phase shift: 22,0 hrs

More information on construction details is available on our website at www.steico.co.uk

We spend approx. 80 % of our lives in enclosed rooms. But are we always aware what we are surrounding ourselves with? STEICO has set itself the target of developing building products which consider the needs of both man and nature. Our products are therefore produced using sustainable natural materials. They help reduce energy use and add considerably to a natural healthy internal climate.



STEICO insulation and construction materials, carry a number of distinguished 'seals of approval' which is a sign of high quality, healthy and functional building products. The raw materials used in STEICO products are certified by FSC® (Forest Stewardship Council®) and PEFC® (Programme for the Endorsement of Forest Certification®), ensuring a traceable and fully sustainable usage of the raw materials. STEICO, the number 1 choice for your sustainable building solutions.

Natural insulation and construction systems for new builds and renovations – roof, ceiling, wall and floor

- Renewable raw materials without harmful additives
- Excellent cold protection in winter
- Excellent summer heat protection
- Energy saving and increased property worth
- Weather tight and breathable
- Excellent Fire Protection
- Excellent sound protection
- Environmentally friendly and recyclable
- Light and easy to handle
- Insulation for healthy living
- Strong quality control
- Compatible insulation and structural building systems

FSC www.fsc.org FSC® C126760 The mark of responsible forestry

PEFC PEFC/04-31-2560 Förderung nachhaltiger Waldwirtschaft www.pefc.de

Institut Bauen und Umwelt e.V.

CERTIFIED COMPONENT Passive House Institute

STRUCTURAL TIMBER ASSOCIATION Building solutions in timber

TRADA member

BBA BRITISH BOARD OF AGREMENT European Technical Approval ETA-06/0208

Quality Management ISO 9001:2015

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