



Building lime innovation

Hemp Lime Technology



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Contents

Introduction to Tradical® Hemcrete®

1. Introduction
2. Benefits & Capabilities
3. Materials

Technical & Practical

1. Technical section
 - a) Environmental
 - Carbon sequestration
 - Life cycle analyses
 - b) Thermal
 - Insulation
 - Thermal Mass
 - Air-tightness
 - Comfort
 - Health
 - Research and Monitoring
 - c) Acoustic
 - d) Fire
 - e) Durability
 - f) Structural
2. Practical - Introduction to Walls
 - a) Wall Designs (Illustrations of wall sections)
 - b) Construction
 - Shuttered, cast and tamped
 - Spray applied
 - c) Maintenance
 - d) Demolition and Alteration
 - e) Economics

FAQs

Frequently Asked Questions

Case Studies

Case studies

Practical Information

Information

Useful Contacts



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Introduction to Tradical® Hemcrete®

1. Introduction

Tradical® construction materials are developed products of the Lhoist Group based on high purity manufactured lime materials. The Lhoist Group is an international business focussed on the supply of high purity lime products to many industries including the construction industry.

Tradical® Hemcrete® is a unique, highly sustainable construction product for the creation of insulating walls as well as insulation layers for floors and roofs.

Hemcrete® is a blend of specially prepared hemp shiv (Tradical® HF) and a special lime based binder (Tradical® HB). Together these products form a bio-composite building material that can be used both for the creation of buildings that have excellent thermal and acoustic properties as well as creating a healthy living and working environment.

Additionally Tradical® Hemcrete® has the ability to make an impact on the future of sustainable building. Helping to reverse the damaging effects of greenhouse gases, Tradical® Hemcrete® locks up approximately 110kg of CO₂ per m³ of wall and provides one of the best value materials for low impact, sustainable and commercially viable construction.

Produced mainly from renewable sources, Tradical® Hemcrete® is mixed on site for fast track construction and delivers high levels of insulation, air-tightness and vapour permeability.

Properties:

- Low density
- High thermal insulation
- High sound insulation
- High thermal inertia
- Good vapour permeability
- Good flexibility
- Fire and pest resistant
- Can significantly reduce CO₂ emissions
- Inherently airtight structures
- Low waste

Hemcrete® Products' Components

Tradical® HF

Tradical® HF is a hemp aggregate made from the stem of the hemp plant. It is chopped, graded and de-dusted to give a natural, sound and breathable product. Cultivated in the UK without agrochemicals, it is harvested annually. A renewable primary material, the industrial processing is mechanical and requires little energy and zero toxic products.

Tradical® HB

Tradical® HB is a special binder based on the purest hydrated air lime blended manufactured to BS EN 459 part 1 with selected cementitious, hydraulic and inorganic materials. This ensures the perfect particle size distribution and setting characteristics to create the correct binder for use with Tradical® HF hemp shiv.

Hemcrete® is available thanks to the collaboration of Lhoist UK Ltd., Lime Technology Ltd and Hemcore Ltd. Lhoist bring their expertise as the largest manufacturers of lime in the world and also the benefit of many years' research and development of binders for hemp in France. Lime Technology specialise in the development of lime based construction materials for environmental building uses. Hemcore are the pioneers of growing and processing industrial hemp in the UK.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

2. Benefits and Capabilities

Combining patented formulations of air-lime based binders with the chopped core of the industrial hemp plant stem, delivers a suite of new building products. These Tradical® Hemp Lime products have excellent performance characteristics for durable, healthy, sustainable and ecologically sound buildings.

Tradical® Hemp Lime products deliver excellent application, durability and aesthetic performance characteristics combined with sustainability, economic, comfort and health qualities that architects, developers, contractors and customers will value.

a) Design

The adaptability of Tradical® Hemp Lime products permits architects and their clients to have free reign on their imaginations for building layout and design. The products can be used with any structural framing system to provide the support for the insulating wall form of Tradical® Hemcrete® in new build and extension applications. The detailing is straightforward and air-tightness, crucial to economic, legislative and environmental performance, is readily achieved due to the nature of the Hemcrete®.

The lightweight nature of the wall form and insulation products means fewer supports and lighter foundations, saving cost and time. The most common structural frame is a timber frame and the vapour permeable Hemcrete® provides a dry environment for the timber such that untreated timber can be used.

Tradical® products also have synergy with other building materials including compressed earth blocks as well as more advanced lightweight thermal insulation aircrete blocks. Tradical® products are also available for renovation and improvement works providing increased insulation to existing buildings.

b) Application

Tradical® Hemp Lime products have workability characteristics that make them easy to use and forgiving in application. The longer pot-life of the binders combined with excellent plasticity increases the efficiency in the building process and reduces on site waste. The products can be cast into shuttering, moulds or forms or can be spray applied just like concrete or render. The dry spray concrete process needs only slight modification to achieve high output, consistent Hemcrete® application

c) Durability

Tradical® Hemp Lime products have physical characteristics that can cope with the flexure that naturally occurs in buildings. The products are rodent, mould and fungus resistant and have excellent fire resistance to conform to current building regulations. The lime based binder has the extended durability common to lime construction products that have easily outlasted their designers.

d) Aesthetics

Tradical® Hemp Lime products provide the possibility for a wide range of excellent quality finishes. The Hemcrete®, render and plaster products can be finished in the normal manner of such products with finishes ranging from as cast to a smooth finish. The Hemp Lime products form an ideal substrate for the application of Tradical® renders, plasters and decorative products. The tight quality control regimes in manufacture ensure consistency and conformity in the selected final appearance.

e) Sustainability

Tradical® Hemp Lime products are among the most ecologically sound of building products. Hemp does not require agrochemicals in its cultivation. The hemp, in common with all similar plants, transforms carbon dioxide during its rapid growth and captures the carbon, releasing the oxygen to atmosphere. This has an immediate positive effect in



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

achieving the sequestration of the principal greenhouse gas CO₂.

The air lime based binders are formulated with products that have lower energy demands in manufacture and distribution. The lower kiln temperatures and lower density of air limes make the products less energy intensive than other common alternatives. Carbonation of the binder as it sets absorbs more of the greenhouse gas, carbon dioxide. Tradical® Hemp Lime products can be used in place of or alongside bricks and blocks, thus reducing the energy required to form building walls, to the benefit of the planet.

f) Economic

Tradical® Hemp Lime products are low energy building products. Construction costs can be lower than for current traditional building materials. The products are lightweight, low density and this allows greater efficiency in transportation and handling as well as requiring shallower foundations thus saving cost. The hardened product ductility characteristics mean that costly movement joints may be avoided.

The enhanced insulation characteristics of hemp lime products can deliver lower running costs through reduced heating and cooling requirements. The vapour permeability of the hemp lime products also means a reduction in the requirements for forced ventilation and de-humidification through the use of air-conditioning installations. The inherent durability of the lime binders means that the buildings will require less ongoing maintenance making them cheaper to own.

g) Comfort & Health

Tradical® Hemp Lime products have a high thermal insulation that means they are comfortable to touch and can radiate a warmth in a room. Their high vapour permeability that facilitates the through transfer of humidity, avoids the development of condensation and trapped moisture within the building. This has combined effects of improving the air quality and controlling the humidity as well as reducing the potential for growth of irritant moulds and fungi that may affect occupant's health. The complete absence of solvents from the Tradical® product range protects builders, occupants, the environment and our workforce.

h) Carbon Balance

The combination of patented air-lime based binders and the woody core of the industrial hemp plant results in construction products that achieve the capture of significant amounts of carbon from the atmosphere. Calculations show that approximately 110kg of CO₂ per m³ of Hemcrete® walling material is sequestered – more for roof insulation. This carbon is then locked into the fabric of the buildings constructed with the Tradical® Hemcrete® products thus having beneficial effects through reversing the carbon debt.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

3. Materials

Tradical® Hemcrete® is a bio-composite building material made by mixing specially prepared hemp shiv (Tradical® HF) with a lime based binder (Tradical® HB).

a) Lime

Lime is produced by heating calcium carbonate (limestone, chalk, shells, coral etc.) in a kiln to a temperature of approx. 900°C. At this temperature the calcium carbonate is chemically changed, or calcined, to form calcium oxide (known as quick lime or lump lime).

Air Limes and Hydraulic Limes

The raw material - calcium carbonate, will vary according to its point of origin. Calcium Carbonate sources that are pure are used to produce high purity limes and these are known as air limes. These high purity limes are used in applications that require the characteristics of consistently manufactured chemical products. Calcium Carbonate sources that are contain impurities are inevitably the more common in geology. Some of these impurities provide the characteristic of hydraulicity in limes. Hydraulicity is a term that relates to the nature of the setting mechanism of lime in a mortar form.

Setting of Lime Mortars

The setting mechanism for mortars with hydraulic limes is a combination of the principal setting where water is required for the formation of cementitious compounds incorporating the impurities; and air where carbon dioxide is absorbed in the recarbonation of the lime to calcium carbonate.

Water and quicklime are combined in a process known as hydration to produce hydrated lime. If only an exact amount of water is added, the end product is a dry powder and is generally known as hydrated lime or lime hydrate. If an excess of water is used (always putting the quick lime into the water) the process is normally referred to as slaking or slacking and the end product is a colloidal gel, often sold in plastic tubs and known as lime putty.

The setting mechanism for high purity air limes is where only the carbon dioxide absorption provides the setting process.

Tradical® air lime is one of the purest air limes produced anywhere in the world.

b) Tradical® HB – Hemp binder

Tradical® HB is a pre-formulated binder based on a high purity air lime manufactured in accordance with the requirements of BS EN 459. It is a blend of UK produced Tradical® lime, Cement and other pozzolanic and mineral additions. It has been carefully formulated and tested over many years to ensure consistent, quality results when used with hemp.

Other Binders

Please note that cementitious or hydraulic binders that have not been designed to be used with hemp may produce unacceptable results. The failure is often related to there being a competition for water between the binder and the hemp. If the binder has insufficient moisture for the hydraulic components to set, then the result can be a mixture of damp hemp and/or dry powder.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

c) Tradical® HF – Hemp shiv

Tradical® HF is industrial hemp that is grown under licence in the UK and processed exclusively for Lhoist UK to be used for construction purposes. The processing of the hemp removes the fibre and chops, grades and de-dusts the shiv ready for construction use.

Hemp History

It is said that production from the hemp plant has 25,000 known uses. Certainly it was grown as a staple crop to provide oil for lighting and fibre for ropes, nets, rigging, cloth and paper. Hemp has been used for Paper production for centuries. In fact the Magna Carter and American Declaration of Independence were written on hemp paper as was the first King James' Bible.

Henry VIII passed a law requiring all farms over 60 acres to grow hemp to satisfy his naval requirements. However by the mid 20th century the growing of hemp was outlawed because of its narcotic content (cannabis). The narcotic content has been selectively bred out of the industrial crop and the first licences for industrial grade hemp farming were issued by the UK Government in 1993. Industrial hemp is now undergoing a renaissance in numerous industries. As well as construction, hemp products are being used today in the automotive industry. The renaissance for hemp cultivation is being actively supported by DEFRA and the NNFCC.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Technical & Practical

1. Technical Section

Tradical® Hemcrete® is a material that will cause a revolution in the construction industry. For any material to be used in the increasingly environmental conscious world it must live up to a number of key criteria.

a) Environmental

There is now a much greater awareness of the environmental impact of the way we live, than at any time in the past. International agreements like Kyoto and reports such as the Stern report show that we must act now to combat climate change. They start to set out a framework for reducing our carbon emissions in order to minimise climate change but recognise that change is already a reality.

Tradical® Hemcrete® is a material that has a very low environmental impact, locks up carbon (negative emissions) and can create very thermally efficient, healthy, comfortable buildings.

Carbon Sequestration

The construction and use of buildings accounts for over 50% of the UK's CO₂ emissions. It is vital that we design and construct buildings that use as little energy as possible in their use. However, it is also possible to make a significant additional contribution to the reduction of CO₂ emissions by building with Tradical® Hemcrete®. When hemp grows it takes in CO₂ and converts it into glucose, cellulose, hemi-cellulose and lignin. The CO₂ molecule is broken down, with the carbon locked up in the plant and the oxygen given back to the atmosphere. It takes 1.84 tonnes of CO₂ to make each tonne of dry hemp. Therefore each tonne of Tradical® Hemcrete® has carbon trapped within it equivalent to 330kg of CO₂. The more Hemcrete® we use, the more CO₂ is removed from the atmosphere.

The materials used in the construction of the walls of a typical house are responsible for tens of tonnes of CO₂ emissions. Replacing all, or some, of these materials with Tradical® Hemcrete® can make a saving of up to 50T of CO₂ per house.

Current Government targets are to improve the thermal performance of buildings to such an extent that the emissions from heating fuels can be reduced by 1T per year per house. The Chancellor has recently announced that he wants all houses to be zero-carbon by 2016. Tradical® Hemcrete® is better than zero-carbon because it locks up carbon as well as being thermally efficient. The thermal efficiency of Tradical® Hemcrete® is also better than many conventional walling materials and this achieves even better insulation.

Making a difference of 50 tonnes of CO₂ emissions per house is a powerful weapon in the fight against climate change.

Life cycle analyses

The French Government have now carried out a full and detailed life cycle analysis of Tradical® Hemcrete® in accordance with ISO 14040. This extensive report is available in French and is currently being translated into English.

Despite the fact that certain very conservative assumptions are made, the LCA shows Tradical® Hemcrete® to be an extremely environmentally friendly material and validates the information given in this pack.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

b) Thermal

The thermal performance of buildings is very complicated. Heat moves by three mechanisms, conduction, convection and radiation. However, building regulations have focussed on the heat lost by conduction. Consequently most building professionals have become obsessed by the U-value of building elements. The U-value gives a figure for the heat energy conducted through a square metre of wall, floor or roof for each degree difference in temperature on each side (in watts per square metre per degree centigrade). This simplification of the true thermal dynamics of building materials leads to some erroneous conceptions of thermal performance of buildings.

Insulation

To calculate the thermal conductivity of a material it is measured in a laboratory test involving a hot plate/hot box. The nature of this test dries the material. Their actual performance in buildings where a degree of moisture is present may be very different from the dry laboratory test. Consequently very few buildings perform thermally as predicted at the design stage. Some buildings perform better, but most fail to perform as well as anticipated by the designer, despite their following current "best" practice.

Thermal Mass

There is no doubt that walls with the same U-values transmit heat at the same rate when they are in a steady state. However, walls in buildings are very rarely, if ever, in a steady state. In fact only a portion of the heat energy on one side of a wall is conducted through to the other side. The rest is simply stored and then released later. The higher the heat capacity of a material, the greater its ability to store heat. Tradical® Hemcrete® exhibits the property of good thermal mass.

Air-tightness

Significant amounts of heat are lost from buildings through air leakage. This simply means the hot air leaks through gaps and takes the heat with it. Hemcrete® is a monolithic material that is inherently air-tight and it is easy to use. There is no need for lots of complicated layers. Just a simple solid cast or sprayed wall. This high level of air-tightness minimises the heat lost through air leakage and draughts. Air-tightness values of better than 2 air changes per hour are readily achievable.

Comfort

The human body perceives comfort by sub-consciously averaging the air temperature and the surface temperature of surrounding walls. It is possible to feel cold in a warm room if the walls are cold. However it is also possible to feel warm in a cooler room if the walls are warm.

The thermal effusivity of Hemcrete® is low which is why it feels warm to the touch. This warm feeling greatly improves the thermal comfort of a building. Experience of Hemcrete® buildings in France shows that sub-conscious feelings of thermal comfort are achieved at an air temperature of 1 to 2 degrees lower than in conventional masonry structures. This means that you feel warm even though the heating is turned down, potentially saving energy and money each year in reduced heating costs, as well as saving on further carbon emissions.

Health

It is now widely recognised that Healthy buildings are ones that deal well with moisture. The word "breathability" is often used to describe materials in these buildings. There are various ways in which materials deal with moisture (water vapour permeability, capillarity and hygroscopicity). Tradical® Hemcrete® performs well in all these and therefore naturally provides a healthy internal environment to all buildings, commercial as well as domestic.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Research and Monitoring

It is important to design and construct buildings that perform in reality rather than just on paper. In order to do this we need to understand all the properties of a material and how these properties relate to the real performance. There is no doubt that walls should prevent as much heat being lost as possible, and they should contribute to the feeling of comfort within the building.

The hemp lime houses built at Haverhill in 2000 and monitored by the BRE yielded lots of interesting data that confirms the information above – see www.projects.bre.co.uk/hemphomes/. On paper the hemp houses had a very poor U-value (around 0.58W/m².K) however the monitoring showed that they out performed the conventional brick and block, cavity-walled, neighbouring houses with a U-value of 0.3W/m².K.

Research in Belgium, France and Germany has shown that Hemcrete® subjected to (simulated) sudden cooling of 20°C takes over 100 hours to reach a steady state of heat transfer compared to 30 hours in cellular concrete and 12 hours in mineral wool of the same thickness. The amount of energy lost from the internal environment in the first 24 hours is less in Hemcrete® than mineral wool (despite the mineral wool having better thermal conductivity) and less than half that of cellular concrete despite having a similar thermal conductivity.

Thermal diffusivity is very low for Tradical® Hemcrete® compared to other materials, which means it will take longer to heat up. When subjected to sudden heating of 20°C, in the above test, it took 850 hours for the Hemcrete® to achieve a steady state and the effect of latent heat transfer within the Hemcrete® was shown to reduce the need for cooling by nearly 10%. This is very important as we see air conditioning costs already rising and set to rise still further in the future.

This research highlights the importance of considering the response of materials under dynamic conditions to assess their thermal performances. It also confirms that thermal performance of Hemcrete® in transient conditions is very good. Just 250mm of Hemcrete® was shown to completely dampen a sinusoidal change in external temperature of 20°C to 0°C over a 24hr cycle.

Some conclusions of the research were that:

“A specific combination of hygrothermal parameters gives strong thermal and hygric inertia to Hemcrete®. A high thermal capacity, with a medium density and a quite low thermal conductivity correspond to a low thermal diffusivity and a relatively low effusivity. These elements help to create a comfortable environment in winter as well as summer conditions”.

“Bioclimatic architecture takes into account the dynamic reality of climate, and it appears that transient performances of such a wall element are definitely higher than what permanent transfer calculations would assess. This conclusion is often observed in wood and earth constructions. Combined parameters can be defined on the basis of material’s transfer and storage parameters to help architects and designers to choose materials when they wish to optimize comfort feelings and low energy demand of their buildings”.

Hemp plasters can also be used in the refurbishment of solid wall masonry structures to improve their thermal performance. In a recent French study 65mm of hemp plaster used as part of a range of energy saving measures reduced the heating bills of a traditional stone building by as much as 75%.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

c) Acoustic

Testing carried out by the BRE on the Haverhill houses see www.projects.bre.co.uk/hemphomes/ showed that hemp lime construction met the acoustic requirements of the building regulations.

Further ongoing research shows that Tradical® Hemcrete® has the ability to absorb up to 90% of air-borne sound. This research is continuing in order to maximise the potential of Hemcrete® to be used in sound-proofing applications.

d) Fire

Fire testing carried out by the CSTB in France on 300mm thick walls made of Hemcrete® blocks laid in lime mortar, with no plaster or render, showed that the wall remained intact for 1hr and 40 minutes. The Hemcrete® blocks did not fail after this time, but the mortar joints did.

Based on the results of these tests Tradical® Hemcrete® has been approved in locations where one hour fire resistance is required.

e) Durability

Although Tradical® Hemcrete® is a relatively recent material, its origins lie in the technology of ancient buildings. The use of plant based materials mixed with mineral binders such as lime or clay go back thousands of years. We know that the effects of the binder (high ph and good capillarity/vapour permeability) create a perfect environment in which to preserve the hemp shiv. Consequently we have confidence in anticipating a life-span of Hemcrete® buildings measured in centuries.

f) Structural

Tradical® Hemcrete® has a typical compressive strength of around 1N/mm² and consequently is not normally used in load bearing applications. Although it may be possible to use thick Hemcrete® walls (particularly when tamped into place) in load bearing a situation for low-rise buildings, we recommend that Tradical® Hemcrete® is used in combination with a timber (or steel or concrete) frame. In this way the frame supports the vertical loads of the roof and upper floors. The Tradical® Hemcrete® may be used to provide part, or all, of the racking strength of the frame subject to the particular building and design application.

Because of the use of a structural frame, the height of the building is dictated by the frame and not the Tradical® Hemcrete®. In France several multi storey buildings have been constructed for clients including the Ministry of the Environment and Housing, using Tradical® Hemcrete® and a concrete frame.

In the UK, the existing steel frame of a typical business park unit has been augmented by a secondary timber frame and the Tradical® Hemcrete® spray applied onto permanent internal formwork to create 500mm thick super-insulating monolithic walls that will allow the building running costs to be slashed.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

2. Introduction to Walls

Tradical® Hemcrete® is used to build walls. In timber frame buildings it provides the wall form, the racking strength and the insulation. In steel and concrete framed buildings, it provides the wall form and insulation in one monolithic product.

Among the important technical considerations for wall infilling materials of timber framed buildings, is that the excellent vapour permeability provided by Hemcrete® is protecting the timber from deterioration mechanisms and extending its longevity. The lightweight of Hemcrete® means that lightweight timber framing and foundation structures can be used which can reduce costs and construction time making Hemcrete® a very efficient building medium.

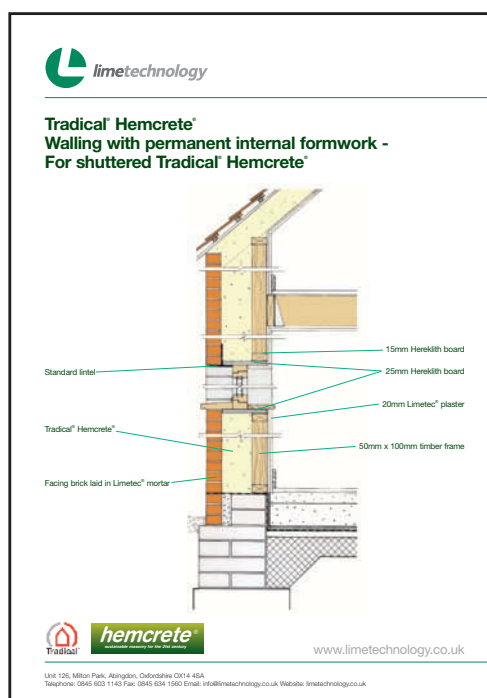
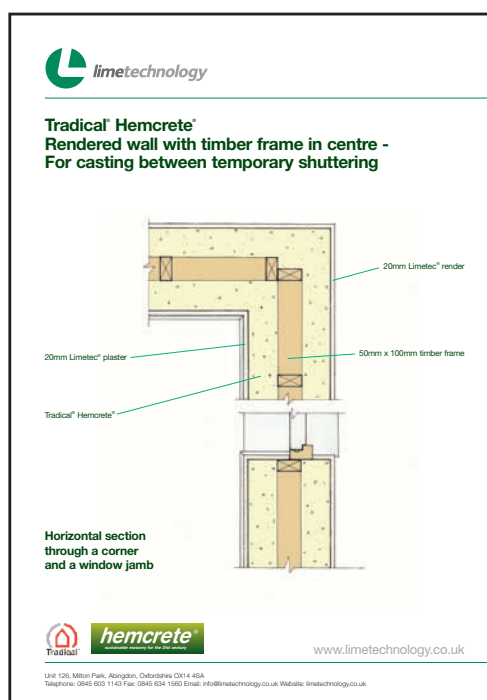
In steel and concrete structures, the vapour permeability also delivers a protective environment against corrosion.

The high thermal performance and air-tightness of the Hemcrete® walls means that single skin structures are sufficient and do not require additional insulation layers. This avoids the need for cavity wall construction and makes construction speed and simplicity a very attractive feature of Hemcrete® walling construction.

The ability of the walls to breathe and the store heat allows for a passive self regulation of the temperature and humidity within the building in general, often reducing the need for air conditioning.

As well as being ideal for new construction, Tradical® Hemcrete® is well suited for the renovation and repair of old timber-framed buildings as a viable and sympathetic replacement for the original wall in-fill.

a) Wall designs Illustrations of wall sections



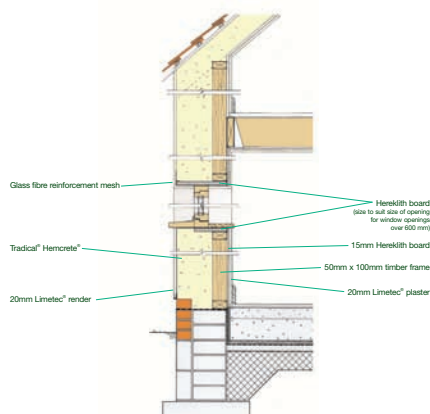


Hemp Lime Technology

Tradical® Hemcrete® Information Downloads



Tradical® Hemcrete® Walling with permanent internal formwork - For spray application of Tradical® Hemcrete®

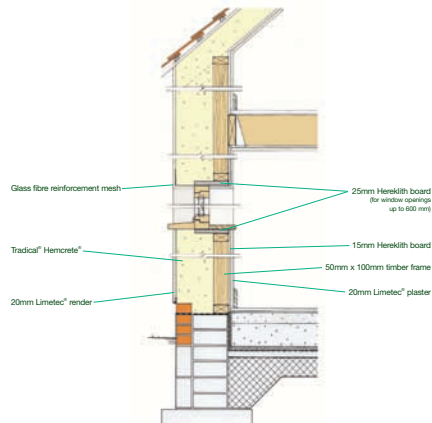


www.limetechnology.co.uk

Unit 126, Milton Park, Abingdon, Oxfordshire OX14 4BA
Telephone: 0845 603 1143 Fax: 0845 634 1560 Email: info@limetechnology.co.uk Website: limetechnology.co.uk



Tradical® Hemcrete® Walling with permanent internal formwork - For spray application of Tradical® Hemcrete®

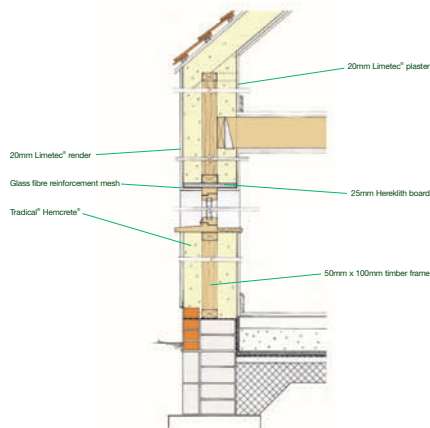


www.limetechnology.co.uk

Unit 126, Milton Park, Abingdon, Oxfordshire OX14 4BA
Telephone: 0845 603 1143 Fax: 0845 634 1560 Email: info@limetechnology.co.uk Website: limetechnology.co.uk



Tradical® Hemcrete® Rendered wall with timber frame in centre - For casting between temporary shuttering

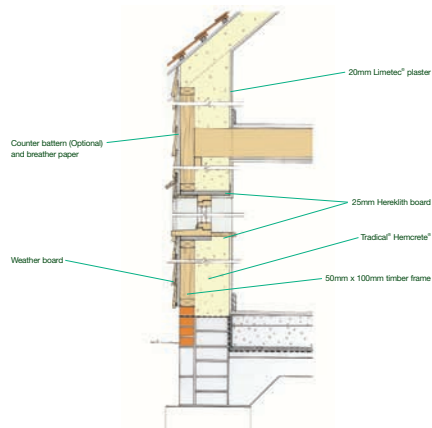


www.limetechnology.co.uk

Unit 126, Milton Park, Abingdon, Oxfordshire OX14 4BA
Telephone: 0845 603 1143 Fax: 0845 634 1560 Email: info@limetechnology.co.uk Website: limetechnology.co.uk



Tradical® Hemcrete® Weather boarded wall as permanent formwork - For spray application of Tradical® Hemcrete®



www.limetechnology.co.uk

Unit 126, Milton Park, Abingdon, Oxfordshire OX14 4BA
Telephone: 0845 603 1143 Fax: 0845 634 1560 Email: info@limetechnology.co.uk Website: limetechnology.co.uk



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

b) Construction

Shuttered, cast and tamped

In general shuttered and cast/tamped walls are suitable for self build or smaller projects (less than 70 cubic metres), or where cheap or volunteer labour is available. In this instance temporary shuttering is fixed to the timber frame with tubular spacers to form the finished size and shape of the walls. The Tradical® Hemcrete® is mixed in the proportion of 1 bale of hemp shiv (Tradical® HF) to 2 bags of binder (Tradical® HB) with approx 60 litres of water per bale of hemp. This material is then tipped into the shuttering and lightly tamped into place. After 12 to 24 hours the shuttering can be removed.

Spray applied

In general spray applied Tradical® Hemcrete® is suitable for larger projects (over 70 cubic metres) where fast-track construction is required. The Tradical® Hemcrete® is mixed dry in the proportion of 1 bale of hemp shiv (Tradical® HF) to 2 bags of binder (Tradical® HB), the water is added close to the nozzle of the spray system. This material is then sprayed against temporary or permanent, single sided shuttering and flattened to the required surface. After 24 hours any temporary shuttering can be removed.

c) Maintenance

Tradical® Hemcrete® will last indefinitely if kept protected from the weather. As such the maintenance of Hemcrete® is really the maintenance of elements that protect it from the weather. All of the following is common sense and good practice:-

Roofs and gutters

Roofs and gutters and downpipes must be kept in a good state of repair and regularly maintained in order to stop water penetration into the walls from above.

Plinth and ground level

Over time ground levels can rise due to the accumulation of debris or overlaying of ground finishes. It is important that ground levels are maintained below the dpc level and that the drainage of rainwater/surface water is dealt with in order to prevent the base of the Hemcrete® wall becoming wet.

Surface finishes

Tradical® Hemcrete® needs to be kept dry and covered with vapour permeable surface finishes. These finishes (render, plaster, brickwork, stonework, timber cladding etc.) should be kept in good condition and only painted with breathable paint finishes.

d) Demolition and Alteration

Tradical® Hemcrete® buildings are expected to last for centuries. When alterations are required any Hemcrete® that needs to be removed can be cut out using simple hand or low power tools (saws or similar - be careful of services). The material that has been removed can be crushed up and remixed with more Tradical® HB in order to form any new walls that are required.

The same is true of Hemcrete® resulting from the demolition of an un-wanted building. If the Tradical® Hemcrete® is surplus to requirements it can be crushed up and spread on flower beds or fields in order to increase the ph of the soil and introduce a mulch. However, in this situation the decomposition of the hemp releases the captured carbon. Nevertheless, the buildings construction and use has had less of an impact on the environment than if it had been built with conventional materials. Growing hemp on the mulched land for use in another building is perhaps a conscientious approach to take.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

e) Economics

Building with Tradical® Hemcrete® can be very economic. The exact costs will depend on size, design and location of the building. The costs of the Hemcrete® walls themselves are towards the top end of conventional construction costs, but the savings offered in other areas can help to offset this in order to produce very competitive buildings.

As Tradical® Hemcrete® use becomes more widespread and construction techniques for the material advance, the costs are anticipated to reduce making Tradical® Hemcrete® more attractive than it already is.

Typical Costs per m²

Spray applied walls.

Typical 300mm thick, spray applied wall.

Timber frame	£28
Tradical® Hemcrete®	£66
Lime Plaster	£30
Lime Render	£30
TOTAL	£154/m²

Typical 400mm thick, spray applied wall.

Timber frame	£28
Tradical® Hemcrete®	£88
Lime Plaster	£30
Lime Render	£30
TOTAL	£176/m²

Typical 500mm thick, spray applied wall.

Timber frame	£28
Tradical® Hemcrete®	£110
Lime Plaster	£30
Lime Render	£30
TOTAL	£198/m²

Shuttered and cast walls.

Typical 300mm thick, shuttered and cast wall.

Timber frame	£28
Shuttering	£20
Tradical® Hemcrete®	£80
Lime Plaster	£30
Lime Render	£30
TOTAL	£188/m²

Typical 400mm thick, shuttered and cast wall.

Timber frame	£28
Shuttering	£20
Tradical® Hemcrete®	£105
Lime Plaster	£30
Lime Render	£30
TOTAL	£213/m²

Typical 500mm thick, shuttered and cast wall.

Timber frame	£28
Shuttering	£20
Tradical® Hemcrete®	£130
Lime Plaster	£30
Lime Render	£30
TOTAL	£238/m²

Minimising Costs

- Use a pre-finished dry lining board
- Use a one coat render on the outside
- Lightweight foundations – Don't over design
- Smaller section of timbers in the wall framing subject to required capacities
- No membranes or vapour barriers.
- Simple construction details.
- Fast application when spray applied.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Frequently Asked Questions

Tradical® Hemcrete®

Design Questions

Q Can I use smaller foundations for a Tradical® Hemcrete® house?

A Yes, you may be able to use shallower/ smaller foundations, subject to the approval of your Engineer and Local Authority Building Control Officer.

Q How thick do the walls have to be to comply with Building Regulations?

A We recommend 300mm for most domestic applications. This achieves a U-value of 0.30 W/m².K (see thermal data sheet).

Q Can Tradical® Hemcrete® be used in a load-bearing capacity?

A Tradical® Hemcrete® has a compressive strength of around 0.8 to 1.0N/mm² (depending on method of application). It is normally used together with a timber frame (or steel or concrete), with the frame transferring the vertical load of the roof and upper floors. The Hemcrete® can be used to provide racking strength to the frame if required.

Q Is Tradical® Hemcrete® available as blocks?

A Yes, blocks are available from Lime Technology Ltd (0845 603 1143). They come in two grades:

- Structural blocks	
Target compressive strength	3N/mm ²
Thermal performance	Not considered yet
CO ₂ emission target	Carbon neutral
- Thermal blocks	
Target compressive strength	1N/mm ²
Thermal conductivity	0.11W/m ² .K
CO ₂ emission target	165kg CO ₂ capture/m ³ (superb carbon sequestration)

Q Is Tradical® Hemcrete® fire proof?

A Yes, in tests at the CSTB in France 300mm Hemcrete® blocks lasted for 1hr 40 minutes and then the mortar joints failed. Monolithic Hemcrete® walls should perform at least as well.

Q Can Tradical® Hemcrete® be used for other building purposes besides walls?

A Yes, Tradical® Hemcrete® has been successfully used in France and the UK for floor slabs, roof insulation and plasters. These product ranges will be launched in the near future.

Q Does Tradical® Hemcrete® need weather protection?

A Hemcrete® walls are normally finished with a lime render or covered with a rain-screen cladding (masonry or timber) of some sort to protect them from the weather. We expect to launch a weather proof Hemcrete®, which will not need rendering, in the near future.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Q If it is used as an external wall does it need a cavity?

A No. Tradical® Hemcrete® provides the insulation and is used as a monolithic (solid) walling material.

Q If used as a solid wall does it need additional insulation to comply with part L?

A No. Provided the wall is a minimum of 300mm thick it achieves a U-value of 0.3w/m²
(See thermal data sheet)

Q Does it need movement joints when used in long walls, if so how often?

A No. The mechanical characteristics of Tradical® Hemcrete® are such that movement joints are not normally required.

Q What protection from rising damp is required?

A A masonry plinth constructed using lime based mortar and appropriate building bricks or blocks and incorporating a standard dpc conforming to current standards is recommended.

Q How air-tight is Tradical® Hemcrete® ?

A Because Hemcrete® is used to build monolithic walls, it is extremely air-tight and air leakage through the walls is negligible. The actual figure is approx. 0.75 g/m²/mmHg. Typical air leakage 1-3 air changes/hour @ 50 pascals

Material Selection

Q Does Tradical® Hemcrete® have a warranty?

A Tradical® Hemcrete® carries a manufacturers warranty covering the replacement of any defective material. The contractor or sub-contractor installing the Hemcrete® would warranty the work (subject to the conditions of the contract used).

Q Does Tradical® Hemcrete® have an Agreement Certificate?

A The process of applying for a BBA certificate has been started and it is expected that the certificate will be issued in 2008.

Q Is Tradical® Hemcrete® approved by the NHBC or the Zurich insurance schemes?

A Tradical® Hemcrete® is approved by Zurich Insurance and complies with their low and zero carbon housing technical standards.

Q How much does it cost to build with Tradical® Hemcrete® ?

A Cost obviously depends on scale and design, however spray applied Tradical® Hemcrete® is comparable with conventional construction costs. Please see Economics section.

Q Is Tradical® Hemcrete® available as prefabricated panels?

A Yes, prefabricated panels are available from Modcell Ltd (07711 081262). Typically 3m x 2m.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Q Can Tradical® Hemcrete® be used in the renovation of old buildings?

A Yes, Tradical® Hemcrete® can be used to form infill panels for historic timber framed buildings. It can also be used as an insulating plaster or render system for the thermal upgrading of masonry buildings. These applications will be launched in the near future.

Q What is the thermal conductivity of Tradical® Hemcrete® ?

A Typically the thermal conductivity is 0.09W/m².K

Q How high can a building of Tradical® Hemcrete® be designed?

A The Hemcrete® is not load-bearing, so the limitation is only on the structural frame.

Q How much CO₂ is locked up in Tradical® Hemcrete® ?

A Spray applied Hemcrete® locks up around 110kg of CO₂ per cubic metre.
Shuttered and cast Hemcrete® locks up around 110kg to 165kg of CO₂ per cubic metre, depending on the level of compaction during construction.

Q Does Tradical® Hemcrete® breathe?

A Yes. The word breathability is often used to describe Hemcrete® buildings. There are various ways in which materials deal with moisture (water vapour permeability, capillarity and hygroscopicity). Tradical® Hemcrete® performs well in all these areas in order to provide a healthy internal environment.

Maintenance Questions

Q Is Tradical® Hemcrete® resistant to pests?

A The Tradical® HB binder protects against rodent and insect infestation.

Q How long will Tradical® Hemcrete® last?

A The use of plant based materials mixed with mineral binders such as lime or clay go back thousands of years. We know that the effects of the binder (high pH and good capillarity/vapour permeability) create a perfect environment in which to preserve the hemp shiv. Consequently we have confidence in anticipating a life-span of Hemcrete® buildings measured in centuries.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Construction Questions

Q How do I know whether it is better to cast or spray the Hemcrete® in my walls?

A In general casting is used for smaller projects (less than 50-70 cubic metres) or where labour is provided by volunteers or self builders. Casting becomes more economic for larger projects (in excess of 70 cubic metres).

Q Can Tradical® Hemcrete® be installed in the winter?

A Yes, providing the temperature is not below 5°C and the material is protected from frost and heavy rain.

Q How do I find a contractor to use Hemcrete®?

A Your Tradical® Hemcrete® supplier will be able to give you a list of spray contractors Who operate nationwide.

Q How high can one build in a day with Tradical® Hemcrete® ?

A There is no real limit other than practical arrangements on the site.

Q Where can I buy Tradical® Hemcrete® ?

A Tradical® Hemcrete® can be purchased directly from Lime Technology Ltd and by Special order (2 to 3 days) from most builders merchants within the Wolseley Group or supplying Castle Cement products.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Case Studies

Adnams Brewery Warehouse and Distribution Centre Hemp Lime insulation walling for 4,400 m² distribution centre

Client:	Adnams Brewery
Architect:	Aukett Fitzroy Robinson
Specialist Engineer:	Lister Beare
Principal Contractor:	Haymills
Location:	Southwold, Suffolk, UK
Project Value:	£5.8 million
Completion date:	September 2006
Key Stats:	100,000 compressed (high density) Tradical® lime hemp blocks
	1,000 cubic metres of low density Tradical® Hemcrete®



The client decided from the outset that the distribution centre, located in a disused quarry, would be built with a focus on environmental responsibility. This led to the selection of Tradical® hemp lime as the material of choice for the walls of both the 4,400 m² distribution centre and the associated commercial vehicle maintenance facility.

Lime Technology, now partners with Lhoist UK, was involved in developing the technology of the wall construction over an eighteen month period. The final construction form was of a diaphragm wall with high density Tradical® lime hemp blocks, with an infill of low density Tradical® Hemcrete®. The high density, compressed blocks were made of a combination of quarry waste, Tradical® hydrated lime and hemp.

Thermal performance of the walls incorporating over 100,000 blocks and 1,000 cubic metres of Hemcrete® was a key focus because of the need to keep the stored drinks at a cool 12 to 14°C during their time in the distribution centre. The success of the hemp lime design meant that, during the design period, it was decided to delete the air-cooling system from the project making a saving of £400,000 on the original costs.

The environmental benefit of using Tradical® Hemp Lime in the construction means that more than 500 tonnes of CO₂ emissions were saved during the building process, as Hemcrete® captures carbon from the atmosphere and locks it up into the fabric of the building.

Tom Woolley, Professor of Architecture at Queens University Belfast, Chair of the Hemp Lime Construction Products Association and author of 'Natural Building' stated: "... the Adnams hemp walled warehouse catapults this environmentally friendly technology into mainstream commercial building."



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Lime Technology Office at Milton Park Hemcrete® insulation walling for business park Head Office

Client:	Lime Technology Ltd.
Architect:	IJP Architect
Specialist Engineer:	Lister Beare
Principal Contractor:	IJP Construction
Specialist Contractor:	Laurent Goudet
Location:	Milton Park, Didcot, Oxfordshire, UK
Project Value:	£0.8 million
Completion date:	February 2007
Key Stats:	80 cubic metres (160 m2) of Tradical® Hemcrete® walling 30 cubic metres (120 m2) of Tradical® Hemcrete® roof void insulation



temporary boarding and these were stripped off within a week and glazing units installed.

The existing suspended ceiling was removed and in its place a 250 mm thick layer of low density Tradical® Hemcrete® roof void insulation was sprayed into place above a joisted ceiling.

The refurbishment of a typical business unit office and warehouse to form the Head Office for Lime Technology, partners with Lhoist UK, was an ideal opportunity to select Tradical® Hemcrete® as the material of choice for the walls of the steel framed, two-storey offices section of the unit.

The original thin section panel walling was removed and a secondary timber framing was installed to support the 500mm thick Tradical® Hemcrete® walling. The wall thickness was increased to a practical maximum in order to achieve the greatest benefit from the insulation properties and therefore reduce the energy consumption for the offices to a minimum. The calculated U value for the Hemcrete® walling is 0.18 W/m².K.

A permanent shutter was installed and the Hemcrete® was spray applied in a single layer application in just four days. Window and door openings had been formed with additional

Thermal insulation performance of the walls and roof was evident immediately as the heatwave conditions experienced during construction demonstrated that the inner space of the office area was much cooler than being in the shade.

The environmental benefit of using Tradical® Hemcrete® in the wall and roof construction means that more than 11,800 kg of CO₂ was captured during the building process, as Hemcrete® captures carbon from the atmosphere and locks it up into the fabric of the building.

The Hemcrete® walling has a lime based render finish and the internal surfaces of the office are plastered with Tradical® Hemcoat® finish products. The whole of the refurbishment of the office and industrial warehouse is targeted to deliver a low carbon, low energy facility using a combination of the best available appropriate technologies.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Practical Information

Hemp Agronomy

1 Hectare = 2.5 Acres

1 Hectare will produce up to 10T of hemp (UK average is 8T)

60% of the processed hemp crop is shiv

1T of shiv is approx. 50 bales

1 bale of Tradical® HF (hemp shiv) contains 200 litres when uncompressed

1 Hectare will produce 5 to 6T of shiv (250 to 300 bales)

1 Hectare will produce enough shiv to build a small house

There are about 540,000 Ha of set aside in the UK

Carbon Dioxide

1 Hectare of hemp will absorb up to 18T of CO₂ as it grows (total crop – shiv, fibre and dust)

The shiv from 1 hectare contains about 10 to 11T CO₂

Tradical® Hemcrete® wall mix contains 108kg CO₂/m³
(Spray applied at a density of 330kg/m³)

Tradical® Hemcrete® wall mix contains around 150kg CO₂/m³
(Shuttered and tamped at a density of 460kg/m³)

Tradical® Hemcrete® roof mix contains 155kg CO₂/m³

Tradical® Hemcrete® wall mix contains 85kg CO₂/m³

Walls of Houses

A small semi detached house of 48 m² GFA with 300 mm thick walls, contains 33 m³ of Tradical® Hemcrete®
This is 165 bales of Tradical® HF and 7.25T of Tradical® HB.
This will lock up 3.6T of CO₂ in the walls

A small detached house of 52 m² GFA with 300mm thick walls, contains 49 m³ of Tradical® Hemcrete®
This is 245 bales of Tradical® HF and 10.8T of Tradical® HB.
This will lock up 5.4T of CO₂ in the walls

A larger detached house of 100 m² GFA with 500 mm thick walls, contains 120 m³ of Tradical® Hemcrete®
This is 600 bales of Tradical® HF and 26.4T of Tradical® HB.
This will lock up 13.2T of CO₂ in the walls

Thermal Performance - U-Values

See Thermal Datasheet
300 mm wall gives 0.30 W/m².K
400 mm wall gives 0.22 W/m².K
500 mm wall gives 0.18 W/m².K

Acoustic Performance

See 3c: "Acoustic" in the Technical and Practical section.



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Useful Contacts

Lhoist UK Ltd

Hindlow
Buxton
Derbyshire
SK17 0EL

www.lhoist.com
uksales@lhoist.com

Castle Cement Ltd

Park Square
3160 Solihull Parkway
Birmingham Business Park
Birmingham
B37 7YN

Technical Helpline: 0845 634 0254
Customer Services: 0845 600 1616
www.castleceement.co.uk

Lime Technology Ltd

Unit 126 Milton Park
Abingdon
Oxfordshire
OX14 4SA

Customer Services: 0845 603 1143
www.limetechnology.co.uk

Hemcore Ltd

Blackwater Trading Estate
The Causeway
Maldon
Essex
CM9 4GG

Tel: 01621 850 099
www.hemcore.com

The Hemp Lime Construction Products Association

Tournai Hall
Evelyn Woods Road
Aldershot
Hampshire
GU11 2LL

Tel: 01252 357 837
www.hemplime.org.uk

The Sprayed Concrete Association

Tournai Hall
Evelyn Woods Road
Aldershot
Hampshire
GU11 2LL

Tel: 01252 357 842
www.sca.org.uk
sca@associationhouse.org.uk



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

The Building Research Establishment

Garston
Watford
WD25 9XX

Tel: 01923 664 000

www.bre.co.uk

BRE

Centre in Innovative Construction Materials
University of Bath
Bath
BA2 7AY

DEFRA

Nobel House
17 Smith Square
London
SW1P 3JR

www.defra.gov.uk

National Non-food Crop Centre

Innovation Centre
York Science Park
Innovation Way
Heslington
York
YO10 5DG

Tel: 01904 435 182

www.nnfcc.co.uk

**Association of Environmentally
Conscious Builders**

PO Box 32
Llandysul
SA44 5ZA

Tel: 0845 456 9773

www.aecb.org.uk

AKS Ward Lister Beare

Manor Court
26 Bancroft
Hitchin
Hertfordshire
SG5 1JW

Aukett Fitzroy Robinson

14 Devonshire Street
London
W1G 7AE



Hemp Lime Technology

Tradical® Hemcrete® Information Downloads

Zurich Insurance

Zurich House
Stanhope Road
Portsmouth
Hampshire
PO1 1DU

www.zurichinsurance.co.uk

Prof. Tom Woolley

Rachel Bevan Architects
80 Church Road
Crossgar
DownPatrick
BT30 9HR
Northern Ireland

www.bevanarchitects.com

ModCell

The Proving House
101 Sevier Street
Bristol
BS2 9LB

Tel: 0117 954 7333
www.modcell.co.uk

Wolseley UK

The Wolseley Centre
Harrison Way
Spa Park
Royal Leamington Spa
CV31 3HH

www.wolseley.co.uk

