Self-insulation system
Construction and Restoration
www.bcb-tradical.com
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Hemp

Plants have always been used in construction, but modern technologies have omitted them to a large extent. The need for materials that are compatible with sustainable building practices, consumer expectations and regulatory requirements have led to a growing interest in their qualities. Among the plants that can be used for construction, hemp certainly holds a prominent place and can be considered a prime example.

An environmental and ecological plant

Hemp has been an essential crop for centuries and thus forms part of our history. Today, its technical qualities, its potential as an industrial plant and its environmental friendliness enable it to suitably meet requirements that are often contradictory. Hemp is a particularly robust plant that is able to quickly produce great quantities of matter with minimal use of fertilisers and without irrigation or phytosanitary treatment (herbicide, fungicide, or insecticide), thus leading to the improvement of soil quality.

A technical plant

Beyond its environmental and sanitary qualities, hemp has physical qualities that make its various co-products particularly interesting as raw materials for construction materials.

From hurds to hemp aggregates

Defibrating the wood of hemp stalk, via a non-polluting and energy-efficient mechanical process, produces an aggregate dedicated to construction. Made up of small parallel channels that carry sap and are filled with air once the stem is dry, hemp aggregates have a very low density and are very efficient from a thermal and acoustic perspective. They are used to make lightweight insulating mortars and concretes that benefit from their porous structure.

Hemp and Lime

The Binder/Hemp relationship: 4 essential points

Hemp hurds can absorb four to five times their weight in water, most of it within less than one minute.
- During mixing, the hurds more or less absorb the majority of the water usually dedicated to the binder. This can seriously affect how the binder behaves, leading to major problems such as incorrect setting, dusting, and desiccation.
- In addition, the water absorbed by the hurds during mixing must be removed. This requires binders providing suitable capillarity.
- Lastly, the binder should not impair the performance characteristics of the hurds. The porous nature of the material as well as its environmental qualities need to be preserved—or even improved—and any products that may constitute a toxic hazard should not be used.

Developing the right lime

To deal with this advantageous yet unpredictable rheology, the use of air lime is an excellent option as it relies less on water to set than hydraulic binders, and provides high capillarity. However, it is difficult to use in its pure state. This is why, thanks to our expertise in air lime technology, BCB has developed Tradiocal® binders that are specifically designed for hempcretes.

Officially approved

The techniques used are patented and are covered by an SMABTP insurance contract. Tradiocal® lime + Chanvribat® aggregate solutions were the first to meet the requirements of the French Professional Rules for the Construction of Hempcrete Structures (see page 14).

Unique qualities!

Performance and technical benefits

- Light and ultralight concretes
- Elasticity
- Porosity, permeability to water vapour
- Sound absorption

Energy efficiency

The thermal characteristics of Tradiocal® Hempcretes enables them to meet the most stringent requirements for low-energy buildings.
- They use less grey energy, resulting in buildings with a particularly high-performance overall energy balance.
- They improve the hygrothermal behaviour and surface temperature of walls.
- They decrease energy consumption in winter and summer alike, both for new buildings and renovations.

An inseparable pair

You must use Chanvribat® combined with either Tradiocal® PF 70/Tradiocal® Thermo or Tradiocal® PF 80 M/Tradiocal® Bâtir to achieve the expected results and benefit from product warranties.

These precautionary measures comply with the French Professional Rules for the Construction of Hempcrete Structures (page 14), which require the characteristics of the hemp aggregate/binder blend to be specified.

The HEMP and LIME solution – where, why, and how?
A comprehensive solution

The increase in energy performance of buildings will lead to a greater demand for materials, whose production will put a heavier burden on the environment.

Tradical® Hempcretes are an exception to the rule and enable environmental impacts to be kept to a minimum (see page 8).

Context

By adopting a Factor 4 approach, France has committed to cutting its greenhouse gas (GHG) emissions by 75%.

If we take the following into account:
• building use (heating, hot water, lighting, etc.)
• the different construction phases (manufacturing of materials, transport, worksites, etc.)
the construction industry produces more than 25% of French GHG emissions, which leaves much room for improvement.

The fight against global warming and the growing scarcity of fossil energy sources have made the energy efficiency of buildings a top priority.

This priority requires a new approach:
• to designing buildings that comply with French RT 2012 energy regulations,
• and to renovating existing buildings that comply with French RT Existant par Élément energy regulations

THE SOLUTION: Tradical® Hempcretes

Within this context, the choice of materials is a key factor influencing both the structure’s operational energy consumption and its overall energy balance, taking into account the energy required to manufacture and work with the material (grey energy).

The characteristics of Tradical® Hempcretes enable them to successfully meet the expectations of the most demanding energy labels. Owing to their hygrothermal behaviour, they are also able to provide innovative and relevant solutions to the difficult issue of thermal improvement for older buildings.

Using Tradical® Hempcretes enables you to considerably reduce the ‘greenhouse effect’ impact of buildings by acting on two parameters:

1. Improving the energy performance of new and renovated buildings while reducing the part of GHG associated with heating or cooling these buildings (see pages 8 to 11)

2. Storing carbon over the long term
‘ZERO carbon’

Environmental and health qualities

Beyond their energy efficiency and their ability to store CO₂, Tradical® Hempcretes have numerous environmental and health qualities.

Environmentally friendly

The life cycle analysis of a hempcrete wall cast in timber framing (1) has shown that Tradical® Hempcretes also have excellent environmental performance ratings with regards to crucial issues such as the depletion of natural resources, water pollution and air pollution.

Providing good indoor air quality

An overall process combining agricultural production without the need for phytosanitary products, mechanical defibration without using any chemical process, the use of mineral binders, the complete absence of any solvents or cosolvents in formulations, and the systematic rejection of any products that may constitute a toxic hazard contributes to guaranteeing the indoor air quality in buildings built with Tradical® Hempcretes.

Producing comfort

Air quality and the comfort of occupants are also improved thanks to being able to provide excellent thermal comfort with low air temperatures.

Carbon storage

- 1 hectare of hemp captures about 15 tonnes of CO₂
- 1 m² of 26-cm-thick wall stores 75 kg of CO₂
- 1 m² of 35-cm-thick wall stores 100 kg of CO₂
- 1 100 m² dwelling built with Tradical® Hempcrete stores about 20 tonnes of CO₂

The CO₂ storage capacity of TRADICAL® Hempcretes allows you to compensate for the greenhouse gas (GHG) emissions arising from the use of other materials in a building and thus achieve a neutral carbon balance. This balance is all the more virtuous for low-energy buildings that require higher thermal performance ratings and thus increased volumes of insulating materials.

‘ZERO carbon’ builds

Constructing buildings that have an overall zero greenhouse effect impact is a widely-accepted objective today. Improving energy efficiency contributes to this goal, but it requires an increase in the quantities of materials used to achieve better wall insulation, which generally leads to greater quantities of GHG emissions in the manufacture of these materials.

Unlike other materials, Tradical® Hempcretes not only optimise their thermal transmission factor in attaining this ‘zero’ objective, but also curb grey energy consumption and the impact on depletion of natural resources as well as improving their greenhouse effect performance by storing even more CO₂. See table below.

Low grey energy consumption

For example, a 26-cm-thick Tradical® Hempcrete wall achieves R = 3 m².K/W which complies with French RT Existant par Élément energy regulations.

Compared to other materials with a similar thermal resistance, the grey energy required to build 1 m² of wall made of Tradical® Hempcrete is low.

FDES label

TRADICAL® Hempcretes have obtained a French environment and health (FDES) label, dated 20/05/2014, after assessment by CEREMA and as per French standard NF P01-010.
Effective

Tradical® Hempcrete is effective due to the capacity of the Air lime + Hemp composite to manage water through a ‘phase change process’ leading to three properties.

PHASE CHANGE PROCESS

• When the ambient outdoor temperature falls, moisture on the inside of the wall condenses into droplets, releasing energy and thus compensating for the drop in temperature. This interaction keeps the ambient indoor temperature relatively warm creating a feeling of comfort.

• Inversely, when the ambient outdoor temperature rises, moisture on the inside of the wall evaporates, consuming energy and thus maintaining the temperature on the surface of the wall.

• In both cases, variations in temperature are countered thanks to this natural regulative process.

Tradical® Hempcrete is not simply insulation—it offers outstanding hygrothermal dynamics.

Tradical® Hempcrete is proactive and CONSTANTLY compensates for variations in temperature and relative humidity to guarantee STABLE and comfortable indoor conditions.

1 - Absorption of high and low temperature variations

High and low temperature variations are absorbed the whole day through in every season.

Comfort in WINTER

A wall with a thickness of 20 cm absorbs 80% of variation in outdoor temperature:

• for outdoor temperatures fluctuating between 6°C and 22°C over 24 hours, and for readings taken over 12 days in May, we can observe that the indoor temperature remains stable between 14°C and 17.5°C.

Comfort in SUMMER

A wall with a thickness of 30 cm absorbs 95% of variation in temperature on the surface of the outside wall:

• for outdoor temperatures fluctuating between 12°C and 30°C, and for readings taken in September, we can observe that the indoor temperature remains stable between 22°C and 24°C.

2 - Regulation of humidity

Tradical® Hempcrete constantly stores excess moisture or compensates for lack of moisture within the structure.

95% of variation in relative humidity is absorbed.

3 - Regulation of indoor wall surface temperatures

The surface temperature remains constant and about the same as the ambient indoor temperature. In actual fact, it is 0.1°C higher on average. This eliminates the ‘cold wall effect’, which would create a feeling of discomfort and lead to over-heating.

Indoor air quality

Tradical® Hempcrete expertly handles in-situ water vapour to keep relative humidity levels at 50-55%.

This value range is the basis for OPTIMAL AIR QUALITY. It prevents the development of micro-organisms, respiratory infections and so on.

Source 1: University of Bath [UK], Dr Mike Laurence
Source 2: COTITA 2013 - DB Chanvre House – Dordogne (France) - Study on the behaviour of Tradical® Hempcrete walls – 30 cm thick - Readings taken in September 2012

Source 1 Source 1

Source 1 Source 1


Source: COTITA 2013 - Maison DB Chanvre - Dordogne - Etude de comportement des murs en Bétons de Chanvre Tradical® - 30 cm d’épaisseur - Relevés Septembre 2012


Indoor air quality

Tradical® Hempcrete expertly handles in-situ water vapour to keep relative humidity levels at 50-55%.

This value range is the basis for OPTIMAL AIR QUALITY. It prevents the development of micro-organisms, respiratory infections and so on.

Source 1 Source 1

Source 1 Source 1

Perfectly cohesive

All Tradical® Hempcrete performance characteristics result from the development of hemp+lime blends (Chanvribat® + Tradical® PF 70/Thermo or Tradical® PF 80 I/Bâtir), that maintain perfect material cohesiveness while enabling mix proportions to be adjusted to adapt characteristics to uses.

R & D

Tradical® Hempcretes have been developed with professionals to meet their specifications and stem from the complementary expertise of partner laboratories and BCB, centre of expertise for the Lhoist Group—one of the world’s leading air lime specialists.

A benchmark blend

The excellent properties of Tradical® Hempcretes have made it a benchmark material used by many laboratories (ENTPE, CEBTP, UCL, CSTB, etc.) in studies conducted as part of R&D as well as in experimental construction projects.

Optimisation

Their use for more than twenty years on a large number of construction sites by trained professionals has enabled us to optimise their performance and confirm that they function properly.

A high-performance material blend

Durability

Tradical® Hempcretes have an excellent cohesiveness that enables them to achieve good results in the freeze-thaw test, despite their low mass density (< 500 kg/m²). Hempcretes prepared with various hydraulic limes (NHL and HL) did not withstand more than two cycles. Tradical® Hempcrete withstood 20 cycles, achieving a result comparable to that obtained with soft limestone.

Compression strength

Similarly, tests conducted on hempcretes prepared with hydraulic limes (NHL and HL) did not exceed compression strengths of 0.46 MPa whereas Tradical® Hempcrete achieved 1.46 MPa. These results confirm the observations made on construction sites and the ability to use Tradical® Hempcretes as a ground slab or wall filler.

Acoustic performance

Tradical® Hempcretes also provide good acoustic performance ratings in restoration and construction situations, contributing to the reduction of indoor and outdoor noise.

Sound reduction index

For a 30-cm-thick Tradical® Hempcretes - Walls

Non-rendered exterior and interior walls BBRI (Belgian Building Research Institute) report for test no. AC 4956

<table>
<thead>
<tr>
<th>Rw</th>
<th>C</th>
<th>Ctr</th>
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</thead>
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<tr>
<td>36 [-1,-5] dB</td>
<td>35.7 dB(A)</td>
<td>31.1 dB(A)</td>
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</tbody>
</table>

Both sides covered with 12.5 mm storey-high panels BBRI (Belgian Building Research Institute) report for test no. AC 4955

<table>
<thead>
<tr>
<th>Rw</th>
<th>C</th>
<th>Ctr</th>
</tr>
</thead>
<tbody>
<tr>
<td>49 [-1,-7] dB</td>
<td>48.5 dB(A)</td>
<td>42.5 dB(A)</td>
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</table>

Fire-resistance

From the outset, Tradical® Hempcretes have been subjected to numerous tests proving the effectiveness of this material in case of fire. For example, a wall with a thickness of 30 cm exposed to a temperature of 600°C does not increase in temperature, does not burn and does not emit smoke or particles. These qualities make it excellent for protecting users or occupants as well as the building structure itself—especially timber-framed or half-timbered structures—whatever the architectural design (see pages 20 to 29).

LCA

From the outset, TRADICAL® Hempcretes have benefited from life cycle analyses (LCA) conducted by the INRA at the request of the French Ministry of Agriculture. Document reference: MAP 04B1 05 01

The standard service life is 100 years

<table>
<thead>
<tr>
<th>Standard NF B10-513</th>
<th>Number of cycles</th>
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<tbody>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>10</td>
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<td>8</td>
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<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>NHL 2</td>
<td>NHL 3.5</td>
</tr>
</tbody>
</table>

Source: Experimental construction in Montholier CEBTP’s final report/Oct. 2005 Tests carried out in accordance with French standard NF B10-513 using samples of comparable mass density

| NHL 2 | NHL 3.5 | HL 5 | Tradical PF70 |
|------------------|------------------|------|
| 3.2 | 3.0 | 2.8 | 2.6 |

Source: Experimental construction in Montholier CEBTP’s final report/Oct. 2005 Tests carried out using samples of comparable mass density

Fire resistance classification

Tradical® Hempcretes - Walls

LNE (French laboratory) report for test no. P113132 DE/11

Rating = B - S1, d0

Tradical® Hempcretes - Roofs

LNE (French laboratory) report for test no. P113132 DE/8

Rating = B - S1, d0

Tradical® Hygrothermal render

LNE (French laboratory) report for test no. P113132 DE/7

Rating = A2 - S1, d0

20 years of research, trials and achievements
The regulatory context

Since April 2007, the C2P\(^{(1)}\)-approved French Professional Rules for the Construction of Hempcrete Structures have served as a reference in the field.

Their purpose is to guarantee the quality of the structures based on the following:

1. The guarantee that the material will perform correctly—especially the binder + hemp aggregate blend. Suppliers commit to providing this guarantee and need to specify the components to be used and the performance ratings achieved.

2. Specialist product and application knowledge that the applier must demonstrate.

These rules 'require confirmation that the materials perform as expected and that users are sufficiently trained'.

Benchmark solutions

Tradicl\(^{\circledR}\), the first hempcretes to comply with French Professional Rules

Experience and reliability

The experience acquired both on construction sites and in laboratories has turned Tradical\(^{\circledR}\) Hempcretes into benchmark solutions for the first French Professional Rules established in this field.

From the outset, their characteristics have enabled BCB to confirm the compliance of Tradical\(^{\circledR}\) Hempcretes with regards to the four uses provided for by the French Professional Rules [page 30].

- Roof insulation
- Floor Insulation
- Wall application
- Render application

1- Commitment to correct performance

BCB guarantees the compatibility between recommended products and is committed to correctly performing blends for:

- Hempcretes
  - Chanvribat\(^{\circledR}\) + Tradical\(^{\circledR}\) PF 70
  - Chanvribat\(^{\circledR}\) + Tradical\(^{\circledR}\) THERMO

- Hemp renders
  - Chanvribat\(^{\circledR}\) + Tradical\(^{\circledR}\) PF 80 M
  - Chanvribat\(^{\circledR}\) + Tradical\(^{\circledR}\) Bâtir

on the condition that they are used in compliance with the application instruction sheets, each corresponding to a specific use [pages 34 to 51].

2- Performance ratings of recommended blends

BCB has had the tests required by the French Professional Rules carried out in accordance with the corresponding procedures and confirms the compatibility of the results with the expected threshold values. (Documents available on request)

3- Mastering application

BCB is also a training service registered with the DIRRECTE in Franche-Comté (France). Since 2008, BCB has been offering professionals a specific training programme to learn how to prepare Tradical\(^{\circledR}\) Hempcretes as well as how to apply them within the fields covered by the regulation.

Training in a few figures

- Training locations: 30
- Accredited trainers: 8
- No. of trainees: >1100

Guarantee

The four Tradical\(^{\circledR}\) Hempcrete and Tradical\(^{\circledR}\) Hygrothermal Render blends benefit from a manufacturer's civil liability, SMABTP contract: ALPHA-BAT Fabricants no. 512806 E 1004.000

\(^{(1)}\) The C2P is a risk prevention commission created by the French Building Quality Agency (AQC) and appointed to analyse professional documents on new techniques used in the building sector. http://www.qualiteconstruction.com/c2p/role-et-missions.html
Meeting thermal regulations

The aim of improving the energy efficiency of existing buildings is a major challenge in the fight against global warming.

Restoring old buildings requires taking account of the specific characteristics of each building and, more specifically, the following:

- Keeping the existing summer comfort
- Avoiding any risk of subsequent damage to buildings by creating condensation points
- Ensuring that the work undertaken preserves the transfer of water vapour through walls
- Preserving the heritage value

There are two regulations on the thermal performance of old buildings:

French RT Existant par Elément energy regulation (1)

This thermal regulation applies to all old buildings:
- with a SHON (net floor area) less than 1000 m²
- with a SHON (net floor area) greater than 1000 m² and with thermal renovation costs at less than 25% of the building’s value

The expected performance takes into account the performance rating of the existing build, especially of opaque walls.

French RT Existant global energy regulation (2)

This thermal regulation applies to buildings where:
- the SHON (net floor area) is greater than 1000 m²
- the cost or renovation is greater than 25% of the value of the building, land excluded

Objectives
- Energy consumption falling between 80 and 165 kWh/m².y
- More comfort in summer

Reference documents
(1) Order dated 03 May 2007
(2) Order dated 13 June 2008
(3) Value available in the reference document THI Ex, on the following website: http://www.rt-batiment.fr/batiments-existants

Hemp render

This specific application provides additional insulation from the exterior. Existing renders are replaced with the thinnest possible layer of new render, thus preserving the architectural and heritage identity of restored facades.

Hemp render can also be used in interiors where only a thin layer is applied to existing walls. It improves the surface temperature of walls by eliminating the ‘cold wall effect’—a source of discomfort and over-heating in winter.

Specific cases

- Buildings that are listed or on the French Register of Historic Buildings
  These buildings are not concerned by thermal performance improvement if work on the envelope would modify the external appearance.
- Old buildings made of special materials are also exempt

In both cases, thermal performance is improved by insulating the walls from the inside with a Tradical® Hempcrete applied as a Tradical® Insulating lining, or with a Tradical® Hygrothermal render, or via a combination of the two.

RESTORATION and successful insulation
Meeting thermal regulations

New buildings targeted by French RT 2012 energy regulations(1), as of 1 January 2013:

- Residential buildings: Houses, grouped housing, apartment blocks
- Tertiary sector buildings: offices, health establishments, education and research establishments, hotels, restaurants, shops, sports and leisure facilities, public buildings in general, and so on.
- Buildings for industrial or workshop use

Thanks to its adaptability, Tradical® Hempcrete can be used with all types of architecture and building systems. Structures that incorporate a hempcrete WALL, FLOOR or ROOF benefit from high-performance self-insulation (no thermal bridges). The variety of possible finishes (lime render, timber cladding, zinc, etc.) allows for creativity.

Meeting thermal regulations

The RT 2012 regulation takes a three-pronged approach:

Energy efficiency of builds

This is defined by the Bbiomax coefficient (the bioclimatic needs of a building) which is calculated according to a building’s characteristics, location and altitude. This coefficient provides a framework for making energy choices (heating, cooling and lighting) without prejudicing the solution system to be implemented.

A building’s energy consumption

A new coefficient has been created, Cepmax, which sets the overall energy consumption limit. All types of consumption are taken into account, including: heating, cooling, lighting, hot water production and auxiliary equipment.

Cepmax < 50 kWh/(m².yr)—a value to be adjusted according to certain parameters: location/altitude, type of building, average surface area of housing units, type of fuel or system used for heating.

Summer comfort in buildings without air conditioning

The design of the building must guarantee an optimum indoor temperature (Tic), falling under a TICref threshold based on the five hottest consecutive days in summer (depending on the location and type of building).

Successful designs

Designing a building that meets French RT 2012 energy regulations means adjusting the different building elements to create an overall performance rating falling in line with three coefficients: the bioclimatic needs of a building (Bbio), its primary energy consumption (Cep) and its optimum indoor temperature (Tic).

Tradical® Hempcrete is perfect for this type of building design, with its easy to manage thicknesses and solutions for walls, floors and roofs.

Case studies (on pages 24 to 29) show how our adaptable solutions help buildings attain RT 2012 targets.

Getting the best comfort for the summer

The various thicknesses of Tradical® Hempcrete structures handle summer comfort with the same efficiency.

In real terms, a 30-cm-thick wall (or 2 bags of Tradical® PF 70 + 1 bag of Chanvribat®) absorbs temperature variations as follows:

- IN SUMMER
  - Outdoor temperature = 30°C
  - Outdoor wall surface temperature = 55°C
  - Indoor wall surface temperature = 22 to 24°C
  - Indoor temperature = 22 to 24 °C

Source: Cotita/temperature readings taken for a house built with Tradical® Hempcrete and designed by DB Chanvre.

The hemp/lime composite’s phase change capacity enables this absorption. Gone is the need to use air conditioning or overnight airing to keep a house cool.

‘Walls provide dynamic regulation’

Examples of primary energy consumption (Cep) for 3 types of building

- Detached house
  - ‘Maison Lumière’
  - Wall thickness = 35 cm
  - Roof thickness = 30 cm

- Grouped housing
  - ‘Les Loges en Josas’
  - Wall thickness = 29 cm
  - Roof thickness = 30 cm

- Apartment block
  - ‘Rue Myrha’
  - Wall thickness = 27 cm
  - Roof thickness = 27 cm

Reference documents:
(1) orders dated 26/10/2010, 28/12/2012, 11/12/2014 & 19/12/2014

Environmental impact

Carbon Storage

Detached house
- ‘Maison Lumière’
- Wall thickness = 35 cm
- Roof thickness = 30 cm

- ‘Les Loges en Josas’
- Wall thickness = 29 cm
- Roof thickness = 30 cm

- ‘Rue Myrha’
- Wall thickness = 27 cm
- Roof thickness = 27 cm

IN SUMMER
- Outdoor temperature = 30°C
- Outdoor wall surface temperature = 55°C
- Indoor wall surface temperature = 22 to 24°C
- Indoor temperature = 22 to 24 °C

Source: Cotita/temperature readings taken for a house built with Tradical® Hempcrete and designed by DB Chanvre.

The hemp/lime composite’s phase change capacity (page 10) enables this absorption. Gone is the need to use air conditioning or overnight airing to keep a house cool.

‘Walls provide dynamic regulation’
The renovation of the Maison Diocésaine Odette Prévost in Chalons-en-Champagne as a low-energy building, with an emphasis on hygrothermal, acoustic and visual comfort, is a perfect example of the possibilities offered by Tradical® hempcrete.

This 19th century building had been abandoned for several years. It was given a substantial overhaul and its interior was reorganised on all four floors. This building is now a hub for several associations, which have access to an exhibition space, meeting rooms, resource rooms and more.

The local sourcing of timber and hemp was a priority and led the main contractor to opt for a hygrothermal render solution for the interior vertical walls.

This multi-purpose and multi-substrate lime/hemp composite provides thermal and acoustic comfort, along with natural humidity control. Its high permeability to water vapour was essential in enabling it to function coherently with the existing structure consisting of composite walls made of ashlar, pit run and solid bricks. ‘Preserving the existing behaviour of the wall avoided any risk of damage over the long term.’ Overall comfort was also achieved through improving the surface temperatures of walls and eliminating the ‘cold wall effect’.

The recorded energy consumption for the building is 84 kWh/m².yr, which clearly places it in the Low-Energy Renovation category.
The building that is now home to the Tourist Office was built at the start of the 16th century in an old quarter called Foires de Champagne, which was famous throughout medieval Europe.

The main contractor restored this building in
keeping with the traditional architecture, but
using modern techniques that have proved their
worth over the last 15 years in the old town of
Troyes, where several buildings have already been
restored using Tradical® Hempcrete.

Perfectly suited to half-timbering systems
Tradical® Hempcrete’s thermal and hygric potential
combined with its mechanical compatibility with
half-timbered structures is a major advantage for
providing suitable insulation.

Thermal performance
The value recorded is barely above 100 kWhPe/
m²/yr, making it eligible for the French Bâtiment
Basse Consommation Effinergie Rénovation label. This project also enabled Troyes to
win the French regional PREBAT 2011 call for projects—the only
town to be awarded a prize for an old building.

Project highlights
• Creation of a short supply chain favouring locally
sourced and sustainable materials
• Creation of a continuously insulated building envelope
by filling half-timbered frames and the roof with the
same Tradical® Hempcrete material to optimise
performance and simplify the different work stages
• Finishes that adhere to the breathability of the walls:
  - EXTERIOR: 300 m² of traditional Tradical® lime render
  - INTERIOR: 3-cm-thick application of Tradical®
    hygrothermal render
• A Tradical® Hempcrete insulating screed was cast in
  the archives section of the basement.

THE PROJECT
Location
Rue Aristide Briand – Troyes – France

Type of building work
Construction of a public building

PROJECT ACTORS
Project owner and main contractor
Ville de Troyes

Thermal design engineering
• MCI THERMIQUES

General contractor
• LEON NOEL

Manufacturer, designer and supplier of
Tradical® Hempcrete
• BCB-Tradical®

Delivered
2nd quarter in 2013

Performance of the envelope
Half-timbered walls (305 m²)
R = 3.53 m².K/W
λ = 0.085 W/m.k
Thicknes = 30 cm

Roof insulation (340 m²)
R = 5 m².K/W
λ = 0.06 W/m.k
Thicknes = 30 cm

Future prospects
- Net floor area
  - Created
  - 302 m²
- Height of the building
  - 14.60 m
  - [ground floor + 2 floors + attic]
- Net floor area (SHOn)
  - 302 m²
- Energy performance
  - 51% increase
- GHG emission
  - 84% improvement

Energy performance
- 51% increase

Natural self-insulation system
Hempcrete made with
Tradical® PF 70 + Chanvribat®

Net floor area (SHOn)
- 712 m²
- Created
- [shon]

Performance was improved
compared to the situation before restoration
GHG emission
84% improvement
Energy performance
51% increase

Separate plug-in space
Performance of the envelope
Rated French low-energy new building (BBC Neuf)

Natural self-insulation system
96 m³
Hempcrete made with Tradical® PF 70 + Chanvribat®

Facade wall
275 m²
R = 4.1 m²·K/W
λ = 0.085 W/m·k
Thickness = 35 cm

Heating
6 steres/yr

Design highlights
- Solar hot water
- Masonry stove
- Natural ventilation
- Green roof
- Rainwater capture

The house
- SHOn (net floor area): 185 m²
- Footprint: 130 m²
- Project completion: 2011

Building and Innovating

Detached House - Maison Lumière Temps - Cléguérec - France

‘Beholding nature’s everchanging beauty!’
The prow of the house bears towards the east to benefit from the sun as it travels across the sky, right from the break of day. A 250° view enables the occupants to contemplate the changing sky and weather, and provides breathtaking panoramas over the distant horizon.

A sense of well-being
To fulfill the wishes of the project owner, Yann Roinnel designed spaces that combine natural light, height and movement, linking one living area to another. Occupants can be inside and out at the same time to enjoy the daylight whatever the weather, experience a thunderstorm under cover, and so on.

Biodynamics / Bio-based materials
With nature at its heart, the house lives in harmony with the sun. Its hot water is produced by solar energy and a sun-shading system controls the incoming heat/light on south- and east-facing facades.
The building materials were chosen for their properties:
- Timber for the framing, joinery and first floor flooring
- Raw earth to build a thermal mass wall
- Terra cotta to cool the floor
- Walls made of hempcrete with its ability to efficiently absorb temperature variations both in summer and winter to maintain a constant, comfortable indoor temperature, along with its capacity for regulating humidity to provide good air quality.
To make everyday life even more pleasant, natural ventilation is provided via an opening system for high windows.

A free hand for architectural design
The final result is simplicity and sobriety, brought to the fore by a creativity that was free to express itself thanks to hempcrete’s extreme versatility.
This was the first ever privately-financed timber-framing/hempcrete project for grouped housing. The project was for a listed site on a 5300 m² plot at the heart of the Loges-en-Josas village perched on a slope of the Bièvre valley in France.

Preserving the identity of the location
This project included 10 different-sized residences, each with a private garden.

The site included three buildings, including a 18th century barn, surrounding a yard. They were so dilapidated that they could not be kept. However, the footprint and location of each building was used for the new structures. The challenge of the project was to ‘adapt an old rural site to contemporary uses.’

The long house, a traditional building in the Île de France region, was reincarnated in a modern version. The apartments are traversing and have floor-to-ceiling windows for extra light. The irregularly-positioned openings in the facades allude to the modifications made over time to the initial design of the buildings—and keep a farm-like spirit too!

A reproducible system
The building system was rationalised and led to the design of a template for creating modules of 5 to 7 m in length and 2.7 m in height. This semi-prefabricated system had several advantages: lifting and transport of lightweight structures, easier on-site storage and quick assembly times.

For ‘de facto’ self-insulation
Thermal performance was even better due to fact that hempcrete was applied in-situ once the structure had been assembled. It was applied as a single continuous layer on facades and the roof. All assembly joints were ‘embedded’ in the thickness of the applied lime/hemp composite and crucial elements were perfectly coated. The framework of vertical walls were offset towards the interior. This choice enabled storey-high panels to be installed for three purposes: as bracing, as a substrate for the interior finishing coat (thin lime render) and as the base of lost formwork. It also led to a 15-cm-coating applied to the vertical framework and especially the areas in contact with floor joisting.

An energy-efficient envelope
The energy performance complies with French RT 2012 energy regulations.
This large project for renovating the rue Myrha in Paris was based on an innovative building—the first social housing of its kind—combining a metallic structure with hempcrete.

The weight factor

Tradicat® hempcrete is an ultralight concrete at 330 kg/m³ compared with 2,230 kg/m³ for reinforced concrete. This was a huge advantage for the Paris site as it enabled the NORTH BY NORTHWEST architects and LM INGENIEUR design engineers to reduce the foundation footprint to 3 m deep completed with 40-metre-deep injections.

A low impact on the environment

The carbon project’s footprint was also very good as the impact of the construction stage was reduced by 60% with regards to Climat Paris plan expectations, and it only represents a quarter of the overall carbon footprint (use+construction) over 40 years compared with a standard building system.

Project highlights

- Efficient building in three stages: reinforced concrete foundations, metallic main structure and Tradical® Hempcrete infill.
- A wide range of facings can be applied to lime and hemp walls: zinc, lime, timber, metal
- A clean work site with reduced impact on the urban surroundings

THE PROJECT

Location
37 rue Myrha Paris 18th district
‘Château Rouge’ sector

Type of building work
Construction of a building with four social housing apartments and a commercial space

PROJECT ACTORS

Project owner: RIVP
Developer for the area: SEMAVIP
Main contractor
- North by Northwest (NWXI), architects
www.nwxw.fr
- LM Ingeinieur
Design Engineering - Structure/Envelope/Environment
13 rue Chapon - 75003 Paris - France
- MDET (budget specialist)

General contractor
- TEMPERE CONSTRUCTION

Manufacturer, designer and supplier of Tradical® Hempcrete
- BCB-Tradicat®

Delivered
1st quarter in 2014

Performance of the envelope

French ‘H&E profil A’ certified

Natural self-insulation system

150 m³ Hempcrete made with Tradical® PF 70 + Chanvribat®

Facade wall

R = 3.17 m².K/W
λ = 0.085 W/m.k
Thickness = 27 cm

Roof

R = 4.5 m².K/W
λ = 0.06 W/m.k
Thickness = 27 cm

Design highlights

- Solar hot water
- Rainwater harvesting
CLASSIFICATION of Lime and Hemp

Accredited Hemp/Lime blends

Test reports concerning the mechanical characteristics of hempcretes and hemp renders

- **Roof insulation**
  - CRDA report no. 2015-05-02: BCB Tradical® THERMO+Chanvribat® roof dated 06/06/2015
  - ENTPE report dated 05/04/2013: Tradical® PF 70 + Chanvribat® roof

- **Floor insulation**
  - CRDA test no. 2013-18: BCB Tradical® Thermo+Chanvribat® screed formula dated 07/03/2015
  - ENTPE report dated 05/04/2013: Tradical® PF 70 + Chanvribat® screed

- **Wall Application**
  - CRDA test no. 2015-05-02: BCB Tradical® Thermo+Chanvribat® wall dated 02/06/2015
  - ENTPE report dated 05/04/2013: Tradical® PF 70 + Chanvribat® wall

- **Render Application**
  - CRDA test no. 2013-17: BCB-Eurochanvre Tradical® Bâtir+Chanvribat® render formula dated 04/11/2013
  - CRDA test no. 2014-07-02: BCB Tradical® Bâtir+Chanvribat® render formula dated 14/11/2014

Guarantee

The product blends used to prepare Tradical® Hempcretes presented in this document have successfully met the tests required by the French Professional Rules for the Construction of Hempcrete Structures:

- Insulating wall
- Floor insulation
- Hemp render
- Roof insulation

Users can benefit from all the guarantees that apply within the scope of this text and the company’s civil liability insurance, and must contact their insurance company about this matter.

Manufacturer’s civil liability, SMABTP contract:
ALPHA-BAT Fabriants no. 512806 E 1004.000
CLASSIFICATION of Thermal performance ratings

The $\lambda$ for Chanvribat® + Tradical® Thermo material blends have been tested in COFRAC-certified laboratories

**INSULATING WALL and INSULATING LINING**
- 1 Chanvribat® + 2 Tradical® PF 70
- 1 Chanvribat® + 2 Tradical® THERMO
- 1 Chanvribat® + 3 Tradical® PF 70
- 1 Chanvribat® + 3 Tradical® THERMO

**THERMAL PERFORMANCE RATINGS**
- Strength (at 90 days): 0.9 MPa 0.7 MPa

**ScreeD INSULATION**
- 1 Chanvribat® + 2.5 Tradical® PF 70
- 1 Chanvribat® + 2.5 Tradical® THERMO

**THERMAL PERFORMANCE RATINGS**
- Strength (at 90 days): 1.1 MPa 0.55 MPa

**SPECIFIC TECHNICAL ASPECTS**

**Protecting insulating walls**
- Half-timbering and embedded framing
  - **EXTERIOR**
    - Coat the structure once the wall has dried.
    - **Drying time:** About 1 week for 2 cm, depending on the weather conditions.
    - Apply a traditional base coat, brown coat, and Tradical® air lime finish in accordance with the French Professional Rules and the French Building Code (DTU 26.1).
  - **INTERIOR**
    - Once the lining has dried evenly (drying time ~ 1 week for 2 cm) and depending on the evenness of the surface, apply either of the following:
      - A traditional lime render consisting of Tradical® PF 80 + 90 to 100 l of sand
      - A mechanically projected lime render consisting of Tradical® PF 80 M + 50 to 70 l of 0/2 sand, i.e. 500 kg/m³
      - A hemp render consisting of Tradical® PF 80 M + Chanvribat® (mix proportions p. 42)
      - A Tradical® Décor render

**Protecting unused roof space**
- Half-timbering, embedded framing and lining walls

**THERMAL PERFORMANCE RATINGS**
- Strength (at 90 days): 1.0 MPa 1.2 MPa

**Conduit and pipe work**
- You must install all conduit and pipe work prior to using the Tradical® Hempcrete. These networks must be covered with at least 2 cm of Tradical® Hempcrete.
Insulating walls - Half-timbering

Mixing method
Mixing can be performed in a concrete mixer.
Add the following in this order:
1 – Water: all at once.
2 – Tradical® PF 70: keep mixing until entirely homogeneous.
3 – CHANVRIBAT®: after having broken up the aggregates.
4 – Empty as soon as the mixture is homogeneous, making sure to avoid excessive mixing.

• Please contact us if you are using a mixing machine.

Mix proportions for 200 l of Tradical® Hempcrete

| Water | Lime | Hemp aggregate for building |
| 60 to 70 L | + 2 bags 64 kg | + 1 bag CHANVRIBAT® |

Application
Complies with the French Professional Rules for the Construction of Hempcrete Structures: Wall Application, and are used within the scope of this document.

- On the inside, install the shuttering panels, making sure to leave sufficient space between the shuttering panels and timber elements.
- On the outside, fasten small and sufficiently flexible shuttering panels to follow surface irregularities.
- Pour the insulating concrete between the shuttering panels and compact it along the inner shuttering panel as well as around timber elements. Apply the Tradical® Hempcrete without compacting it along the outer shuttering panel.
- Quickly remove the outer shuttering panel and smooth the insulating concrete using a float to adapt the filling to the geometry of the timber. Make sure to leave a 2 cm recess to allow the render to come flush with the bare timber.

Visible half-timbering on both wall facings:
We strongly recommend against merely filling the depth of the timber. When this is unavoidable (interior partitioning wall, very thick timber, etc.), you must take all necessary precautionary measures to ensure that the hempcrete adheres properly to the timber structure and avoid thermal bridges due to possible removal of the timber (grooves, laths, secondary structures, etc.).

Compliant with French Professional Rules
Tradical® Hemponses
• Tradical® PF70 + Chanvribat®
• Tradical® Thermo + Chanvribat®

Technical qualities
• Ultralight insulating concrete
  - 320 kg/m³ with Tradical® PF 70
  - 280 kg/m³ with Tradical® Thermo
• Can be applied to substrates that are
  - old / new
  - very heterogeneous/homogeneous
  - highly uneven
• High elasticity

Works
They are used to fill and insulate timber-framed walls with a visible timber structure on one side. This makes them particularly suited to the renovation of half-timbered houses as an alternative solution to cob, all the more so as their permeability to water vapour leads enables timber elements to dry out over time.

Notes:
Walls made of Tradical® Hempcrete provide an insulating function. The structure must be self-supporting. Therefore, it is not appropriate to overlay any insulation, which would be detrimental to the continuity of the structure.

Tradical® Hemprecites does not play a mechanical role. This is provided by the timber framing or half-timbering.

Mechanical application
Please contact us
**Mixing method**
Mixing can be performed in a concrete mixer. Add the following in this order:
1. Water: all at once.
2. - Tradical® PF 70 or Tradical® Thermo: keep mixing until entirely homogeneous.
3. - CHANVRIBAT®: after having broken up the aggregates.

If you are using a mixing machine, planetary or bucket, please proceed in the following order: 3 - 1 - 2

Mix until the mixture is homogeneous, making sure to avoid excessive mixing.

PLEASE NOTE: Empty as soon as the mixture is homogeneous.

**Mix proportions for 200 l of Tradical® Hempcrete**

<table>
<thead>
<tr>
<th>Water</th>
<th>Lime</th>
<th>Hemp aggregate for building</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 L</td>
<td>2 bag(s) + 44 kg Chanvribat</td>
<td>1 bag Tradical® PF 70 + Chanvribat®</td>
</tr>
</tbody>
</table>

**Application**

Complies with the French Professional Rules for the Construction of Hempcrete Structures: Wall Application.
- Fasten a first row of shuttering panels on either side of the framework following the thickness chart for coating the timber. (Recommended shuttering panel height: 0.80 to 1.00 m)
- Pour the insulating concrete between the shuttering panels in layers of 10 to 15 cm.
- Compact each layer along the shuttering panels and around timber elements only.
- You can remove the shuttering panels 15 min after having finished filling.
- Set the shuttering panel back into place, making sure to cover 10 cm above the top of the recently stripped part.

*The moisture transfer property of the hempcrete wall must be preserved.*

**Coating the timber**

Framework elements must be coated with a minimum thickness of Tradical® Hempcrete according to the timber cross-section (thickness = dimension b parallel to wall surface)

**Thickness chart**

<table>
<thead>
<tr>
<th>Frame thickness b (cm)</th>
<th>4 cm</th>
<th>5 cm</th>
<th>6 cm</th>
<th>7 cm</th>
<th>8 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum coating e (cm)</td>
<td>7 cm</td>
<td>7.5 cm</td>
<td>8 cm</td>
<td>8.5 cm</td>
<td>9 cm</td>
</tr>
</tbody>
</table>

**Technical qualities**

- Ultralight insulating concrete
  - 320 kg/m³ with Tradical® PF 70
  - 280 kg/m³ with Tradical® Thermo

**Notes:**

Walls made of Tradical® Hempcrete provide an insulating function. The structure must be self-supporting. Therefore, it is not appropriate to overlay any insulation, which would be detrimental to the continuity of the structure.

Tradical® Insulating Hempcrete does not provide any mechanical function. It is provided by the timber framing.

**Highlights**

- Ultralight insulating concrete
- 320 kg/m³ with Tradical® PF 70
- 280 kg/m³ with Tradical® Thermo

**Compliant with French Professional Rules**
Tradical® Hempcretes meet the requirements of the French Professional Rules for the Construction of Hempcrete Structures: Wall Application, and are used within the scope of this document.
Mixing method for mix proportions A & B

Add the following in this order:
1 - Water
2 - Tradical® PF 70 or Tradical® Thermo: Mix until you obtain a homogeneous slurry
3 - Broken up Chanvribat®
   Use the Tradical® Hempcrete as soon as the mixture is perfectly homogeneous making sure to avoid excessive mixing.

Mix proportions A – Thick to thin for 200 l of Tradical® Hempcrete
- Between wall and shuttering
- On wall, by mechanical projection

<table>
<thead>
<tr>
<th>Water</th>
<th>Lime</th>
<th>Hemp aggregate for building</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 to 70 L</td>
<td>2 bags 36 kg</td>
<td>1 bag Chanvribat</td>
</tr>
</tbody>
</table>

Mix proportions B - Trowelling for 200 l of Tradical® Hempcrete

<table>
<thead>
<tr>
<th>Water</th>
<th>Lime</th>
<th>Hemp aggregate for building</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 L</td>
<td>2 bags 36 kg</td>
<td>1 bag Chanvribat</td>
</tr>
</tbody>
</table>

Performance
The Tradical® Hemp Lining ensures the structure's continuity and thus accentuates the original characteristics of the wall: inertia of a stone wall, hygrothermal properties of a brick or aerated concrete wall, etc.

• Zero-carbon structure
• R of lining complements the initial R of wall
• Adjustable thickness
• Summer / Winter comfort
• High thermal performance
• Moisture control
• Regulated wall surface temperature
• High permeability

Admissible substrates
All mineral substrates complying with the French Building Code (DTU 26.1)

Technical qualities
• Ultralight insulating concrete
  - 320 kg/m³ with Tradical® PF 70
  - 280 kg/m³ with Tradical® Thermo
• Can be applied to substrates that are
  - old / new
  - very heterogeneous/homogeneous
  - highly uneven
• High elasticity

Interior
Compliant with French Professional Rules
Tradical® Hempcretes enable you to apply an insulating lining on interior walls and partitions.

Highlights
• High thermal performance
• Moisture control
• Regulated wall surface temperature
• High permeability

Mechanical application
Please contact us
Thick lining
over 15 cm
- Infill between the wall and shuttering ➔ Mix proportions A
- Mechanical projection ➔ Mix proportions A
- Trowelling ➔ Mix proportions B

A secondary support framing system is installed for the wall at a distance of at least 4 cm from the NEW or OLD wall.

Medium lining
from 11 to 15 cm
- Infill between the wall and shuttering ➔ Mix proportions A
- Mechanical projection ➔ Mix proportions A
- Trowelling ➔ Mix proportions B

A secondary support framing system with a trapezoidal cross-section is fastened to the NEW or OLD wall.

Thin lining
up to 11 cm
- Mechanical projection ➔ Mix proportions A
- Trowelling ➔ Mix proportions B

Traditional application up to a thickness of 11 cm on a NEW or OLD wall.

Insulating lining - Interiors

Application
Secondary support framing
1 - Follow the thickness chart for coating the timber.
2 - Keep a space of at least 4 cm between the wall and the framework for a thick lining.
3 - It is better if the framework is positioned to about a third of the thickness of the ‘Thick lining’, towards the inside.

Fixing the secondary framing
Screws are positioned alternately on one side and the other of the vertical axis of the framework to strengthen its stability. Coating the framework secures the structure.

Thickness chart for coating the secondary framing

<table>
<thead>
<tr>
<th>Frame thickness b</th>
<th>4 cm</th>
<th>5 cm</th>
<th>6 cm</th>
<th>7 cm</th>
<th>8 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum coating c</td>
<td>7 cm</td>
<td>7.5 cm</td>
<td>8 cm</td>
<td>8.5 cm</td>
<td>9 cm</td>
</tr>
</tbody>
</table>

Base coat for insulating linings:
- 1 bag of Tradical® PF 70 + 60 l of 0/4 sand
- or 1 bag of Tradical® PF 80 + sand
- with Tradical® Thermo + 50 to 60 l of 0/4 sand

Drying time: 3 to 5 days

Infill between the wall and shuttering
- Wet the substrate and leave to dry
- Set up the shuttering panels.
- Fill in between the substrate and the shuttering panels in layers of 20 cm, lightly compacting the Tradical® Hempcrete along the shuttering panels and around the framework.
- Remove the shuttering panels and repeat the process

Mechanical projection & trowelling
- Wet the base coat.
- Apply in successive layers 3 to 5 cm thick. Each layer is applied as soon as the previous has hardened.
- For trowelling, smooth and trowel after each application.

Take note

Trowelling
This type of application requires the mixing time to be adjusted to obtain the required smoothness.

Infill between the wall and shuttering
Optional base coat

Shuttering panels
The quality of the surface obtained using this technique is perfect for applying a thin Tradical® Décor render.

Wall
Is understood to be mineral and with uncoated original masonry.
Mixing method

Mixing can be performed in a concrete mixer. Add the following in this order:
1 – Water: all at once.
2 – Tradical® PF 80 M or Tradical® Bâtir: mix until a homogeneous paste is obtained (3 to 5 min).
3 – CHANVIRIBAT®: after having broken up the aggregates.
4 – Mix slowly until all aggregates are entirely and evenly coated, by adjusting the quantity of water if necessary.

The mortar can be used immediately, but it will be easier to use after letting it rest for about 5 min (better adherence). The consistency of the mortar can be adjusted by adding water progressively, as and when it is used, depending on application conditions (substrate, desired thickness, speed of execution, atmospheric conditions, etc.).

Mix proportions for 200 l of hygrothermal render

<table>
<thead>
<tr>
<th>Creamy texture</th>
<th>Standard texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water: 100 to 110 L</td>
<td>Water: 100 to 110 L</td>
</tr>
<tr>
<td>Lime: 5.5 bags +165 kg</td>
<td>Lime: 4 bags +165 kg</td>
</tr>
<tr>
<td>Hemp aggregate: 1 bag Chanvribat</td>
<td>Hemp aggregate: 1 bag Chanvribat</td>
</tr>
</tbody>
</table>

Interiors and exteriors

**Technical qualities**
- Tradical® Hygrothermal render is a hemp render with insulating properties
- It can be applied indoors and outdoors, on all kinds of clean and sound substrates, and is compatible with a wide variety of finishes.
- Lightweight insulating render
  - 925 kg/m³ with Tradical® PF 80 M
  - 500 kg/m³ with Tradical® Bâtir

**Performance**
- Rectifies highly uneven surfaces.
- Used as brown coats on materials exhibiting low mechanical strength.
- Considerably improves thermal comfort, by increasing surface heat and controlling humidity, especially on cold walls.
- Considerably improves acoustics through absorption.
- Improves thermal inertia

Highlights

Example of hygrothermal render colours

Mechanical application:
Please contact us
Hygrothermal render

Application

Complies with the French Professional Rules for the Construction of Hempcrete Structures: Render Application.

Base coat on smooth masonry substrates

1 bag of Tradical® PF 80 + 40 l of 0/4 sand
or With Tradical® Bâtir + 0/4 sand mixed as per the substrate (see technical data sheet)

Base coat on raw earth walls and masonry units laid with hollow joints:

6 bags of Tradical® PF 80 M + 1 bag of Chanvribat®
or 4 bags of Tradical® Bâtir + 1 bag of Chanvribat®

On a raw earth wall: apply a limewash as the base coat progresses

Hygrothermal render

The render is applied at least 48 hours after applying the base coat. Before applying the brown coat, either of the following must be performed on the base coat:
- Wet it
- Or throw on a bonding slurry (mixed with 25 litres of water for 1 bag of Tradical® PF 80 M) as the render work progresses.

1 – The render is applied in several successive layers 2 to 4 cm thick.
Each layer is applied after the previous one has hardened without exceeding a 12 to 24-hour period between each layer.
2 – The 1st layer must be thrown on with a trowel. Subsequent layers are either thrown on with a trowel or applied with a float.
3 – Smooth and trowel after each application.

Interior render finish

The hygrothermal render can be kept as is depending on the desired appearance:
- a lime wash Tradical® Lait de chaux appliqué ‘al secco’
- a render Tradical® PF 80 or PF 80 M + sand
- a render Tradical® Décor

Exterior render finish

In accordance with the French Building Code (DTU 26.1), allow for a capillarity break at the base of the wall using Tradical® PZ. The following finish must be applied onto the hygrothermal render:
- a single coat render Tradical® PF 80 M + 50 to 70 l of 0/2 or 0/4 sand

Mechanical application:

Please contact us
Mixing method
Mixing can be performed in a concrete mixer. Add the following in this order:
1 – Water: all at once.
2 – Tradical® PF 70: keep mixing until entirely homogeneous.
3 – CHANVRIBAT®: after having broken up the aggregates.
4 – Empty as soon as the mixture is homogeneous, making sure to avoid excessive mixing.

• Please contact us if you are using a mixing machine.

Mix proportions for 200 l of insulating screed

<table>
<thead>
<tr>
<th>Water</th>
<th>Lime</th>
<th>Hemp aggregate for building</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 to 100 L</td>
<td>2.5 bags</td>
<td>1 bag Chanvribat</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 to 100 L</td>
<td>2.5 bags</td>
<td>1 bag Chanvribat</td>
</tr>
</tbody>
</table>

Application
Complies with the French Professional Rules for the Construction of Hempcrete Structures: Floor Insulation.
• Spread the mixture and distribute it using a rake.
• Level using a darby without compacting.
• Even out the surface using a float without trying to obtain a smooth surface.

Insulating screeds – Ground and floor

Compliant with French Professional Rules
Tradical® Hempcretes meet the requirements of the French Professional Rules for the Construction of Hempcrete Structures: Floor Insulation, and are used within the scope of this document.

Works
They can be used to build insulating screeds:
• On solid ground floor thanks to their thermal performance characteristics
• On upper storey floors owing to their low density as well as their thermal and acoustic performance characteristics

Performance
• Thermal insulation
• Inertia
• Improved acoustics
• Levelling of existing floors with significant differences in evenness
• No excessive load thanks to a very low density:
  375 kg/m³ with Tradical® PF70
• Flexibility that allows for adaptation to possible structural deformations

Installation of flooring
Must be performed once the insulating screed has completely dried (1 week for 1 cm) and in accordance with the French Professional Rules for the Construction of Hempcrete Structures: Floor Insulation

Permeability
In all cases, at least one of the sides of the complete ‘hempcrete screed + floor covering’ system should be permeable.

Highlights

• Lime
• Hemp aggregate
• Water

1 bag = 45 kg

80 to 100 L

2.5 bags = 65 kg
Flexible flooring on a Tradical® PF 70 compression screed + sand 3 to 4 cm thick.

Floorboards nailed to floor joists installed on floating floor joists on top of a thin underlay made of wood fibre panels or cork, provided that the surface is sufficiently even.

Cemented floor tiles on a Tradical® PF 70 compression screed + sand 3 to 4 cm thick.

Cemented terracotta tiles slurry on wet Tradical® PF 70 bonding screed + sand 3 to 4 cm thick.

**Floating floorboards**

directly on screed on top of a thin underlay made of wood fibre panels or cork, provided that the surface is sufficiently even. *Note: Flooring with insufficient compression strength must be installed on a compression screed.*

**Cemented floor tiles**
on a Tradical® PF 70 compression screed + sand 3 to 4 cm thick.

**Cemented terracotta tiles**
slurry on wet Tradical® PF 70 bonding screed + sand 3 to 4 cm thick.

Precautionary measures for application

The minimum thickness of Tradical® Hempcrete insulating screeds is 15 cm. For an intermediate floor, it is 10 cm.

- **On wooden floors:**
  Do not apply any coating that is impermeable to water vapour under the insulating screed made of Tradical® Hempcrete.

- **On solid ground floors:**
  Make sure that there is no risk of rising humidity and take all the necessary precautionary measures (e.g. peripheral draining and well-ventilated packed stone).

The four ranges of finishes shown below can be applied to solid ground floors and upper storey floors.
Mixing method
Mixing can be performed in a concrete mixer. Add the following in this order:
1 – Water: all at once.
2 – Tradical® PF 70 or Tradical® THERMO: keep mixing until entirely homogeneous.
3 – CHANVRIBAT®: after having broken up the aggregates.
4 – Empty as soon as the mixture is homogeneous, making sure to avoid excessive mixing.

Please contact us if you are using a mixing machine.

Application
Must be applied in accordance with the French Professional Rules for the Construction of Hempcrete Structures: Roof Insulation.
- Empty the mixture onto the lower face that serves as the bottom side of the lost formwork. Spread out without compacting.
- Adjust thickness making sure to remain at least one centimetre below the upper level of the rafters.
- Float lightly to even out the surface.
- Install the roofing (including a wind barrier).

Mix proportion for 200 l of Tradical® Hempcrete

<table>
<thead>
<tr>
<th>Water</th>
<th>Lime</th>
<th>Hemp-aggregate for building</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 to 50 L</td>
<td>1 bag</td>
<td>22 kg Chanvribat</td>
</tr>
<tr>
<td>43 L</td>
<td>1 bag</td>
<td>18 kg Chanvribat</td>
</tr>
</tbody>
</table>

Precautionary measures for application
To guarantee the continuity of the insulation, the inner facing that serves as the bottom side of the lost formwork must be installed on sag rods or counter-rafters.

Mechanical application
Please contact us

Compliant with French Professional Rules
Tradical® Hempcretes meet the requirements of the French Professional Rules for the Construction of Hempcrete Structures: Roof Insulation, and are used within the scope of this document.

Works
Chanvribat® blended with Tradical® PF 70 or Tradical® THERMO enables you to prepare ultralight mortars to thermally insulate roofs:
- In sloping parts prior to installing the roofing
- In the depth of attic floors
- On the floors of unused attic spaces

Performance
- High thermal performance
- Improved acoustics
- Summer comfort
- High inertia
- Moisture transfer
- A lightweight solution

Characteristics
210 kg/m³ with Tradical® PF 70
190 kg/m³ with Tradical® Thermo
Tradical® roof insulation guarantees durability, by preventing both any risk of the insulating material settling or sliding and any risk of damage by pests. Tradical® roof insulation does not provide any mechanical function.

Highlights
Air lime is produced by firing the purest limestone to 900°C. In all civilisations and on all continents, mankind has been able to draw upon this harmless natural material to create structures and materials as varied as foundations, bridges, water pipes, waterproofing, tanking, masonry, renders and whitewashes.

The air lime produced in the factories of the Lhoist Group today is a modern material that can be used to manufacture high-technology products, thanks to end-to-end control of the production chain.

Both pure and formulated BCB air limes carry the Tradical® label as proof of the high product quality requirements imposed: constant fineness, very high levels of free lime, stability and more.

Reference documents

- Masonry & Rendering using Lime
- Natural Hempcrete Insulation
- Lime for Interiors
- Repairing Stone
- Historic buildings

Visit our website
www.bcb-tradical.com

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