



Tradical® Hempcretes

Self-insulation system

Construction and Restoration

www.bcb-tradical.com



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Hemp + Lime

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Conforme
RT 2012



Conforme
RT
Existant
par Élément

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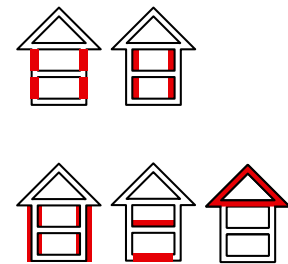
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The HEMP and LIME solution –

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 Tradical® binders that are specifically designed for hempconcretes.

Officially approved

The techniques used are patented and are covered by an SMABTP insurance contract. Tradical® 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).



where, why, and how?

An inseparable pair

The binders used and the characteristics of the hemp aggregate (particle size distribution, humidity, etc.) have a direct influence on the performance of hemp mortars and hempcretes.

You must use Chanvribat® combined with either Tradical® PF 70/Tradical® Thermo or Tradical® PF 80 M/Tradical® 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.

Unique qualities!

Performance and technical benefits ↗

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

Environmental and health qualities ↗

- Agricultural production without phytosanitary products
- Minimal depletion of natural resources
- Carbon storage
- Indoor air quality: no VOCs or known toxic elements

Energy efficiency ↗

The thermal characteristics of Tradical® 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.

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.

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



Radical®:

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: Radical® 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).

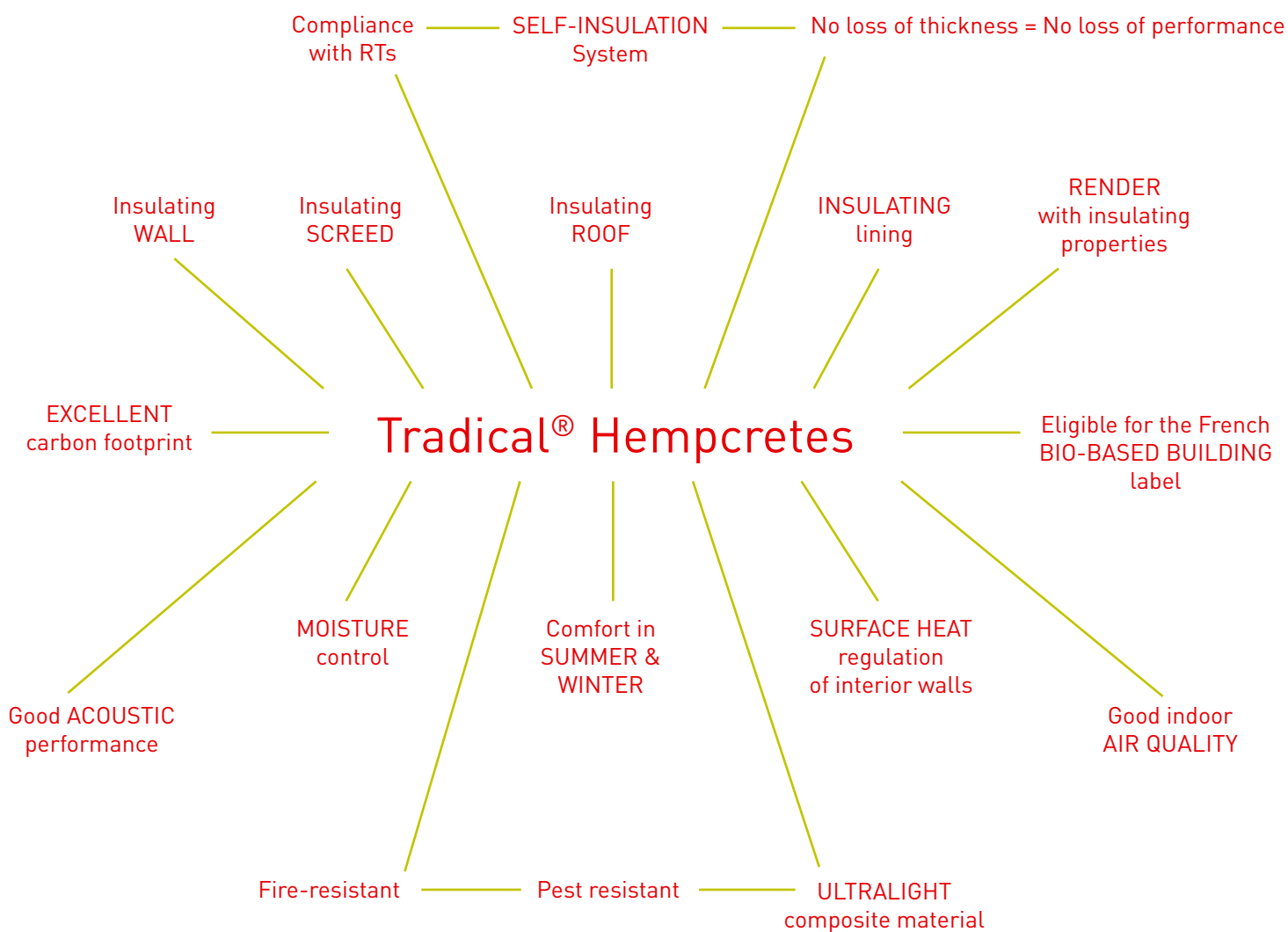
The characteristics of Radical® Hempcretes enable them to successfully meet the expectations of the most demanding energy labels. Owing to their **hygrothermal behaviour**, they are also able to provide innovative and relevant solutions to the difficult issue of thermal improvement for older buildings.

Using Radical® 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



high thermal and environmental performance



'ZERO carbon'

Tradical®:

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
(timber framing)*

stores 75 kg of CO₂

*1 m² of 35-cm-thick wall
(timber framing)*

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.

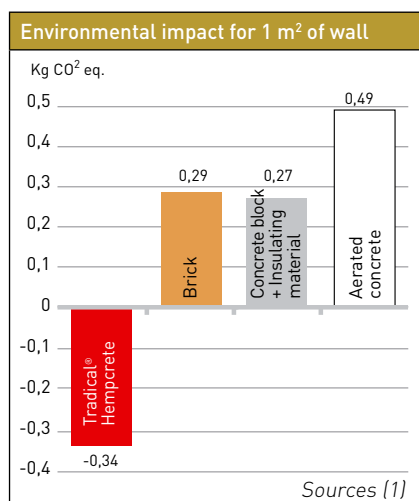


high thermal and environmental performance

'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.



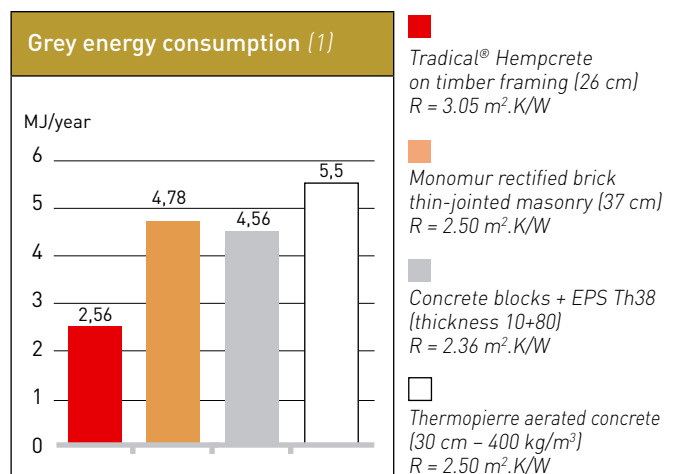
In accordance with French standard NF 10.010 [3], the 'greenhouse effect' impact of Tradical® Hempcrete is **-0.34 kg of CO₂ eq./FU/year**, whereas the majority of materials used emit more than **+0.25 kg of CO₂ eq./FU/year** [1]

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.

Low grey energy consumption

For example, a 26-cm-thick Tradical® Hempcrete wall achieves $R = 3 \text{ m}^2.K/W$ 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.



[1] The data published in this document comes from the INIES database [2] and from the life cycle analysis of a hempcrete wall cast in timber framing, performed by the French National Institute of Agricultural Research (INRA) in accordance with the French standard NF 10.010 [3] at the request and with the support of the French Ministry of Agriculture and of the French Environment and Energy Management Agency (ADEME). Tradical® Hempcretes were chosen for this analysis.

[2] This is the French reference database on the environmental and health characteristics of construction products. (<http://www.inies.fr>).

[3] This standard governs the life cycle analysis (LCA) of construction products.

Environmental impacts are assessed based on a functional unit (in this case: 1 m² of wall with a similar thermal resistance $R = 2.36$ to $3 \text{ m}^2.K/W$) and expressed for a year in the life of the structure.

The 'greenhouse effect' impact takes stock of emitted and stored GHG.

Effective

Radical® 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

Outstanding

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.

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

Radical® 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

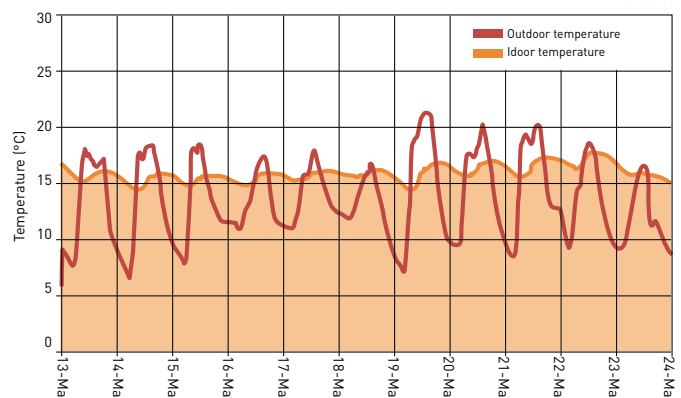
High and low temperature variations are absorbed the whole day through in every season.

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.

Source 1

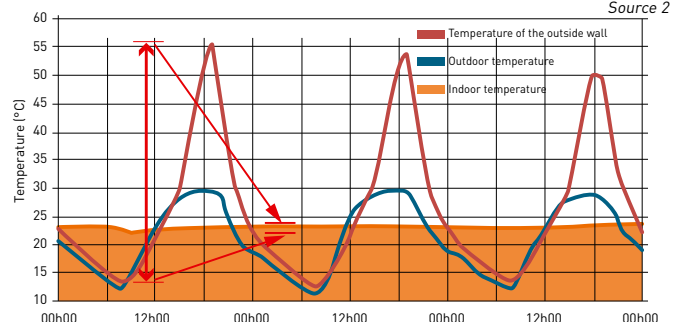


Comfort in SUMMER

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.

Source 2



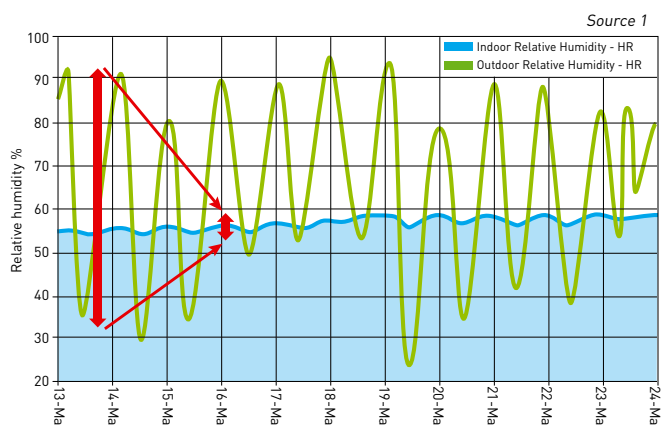


hygrothermal dynamics*

[*] 'Insulation that stands out from the crowd'

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.

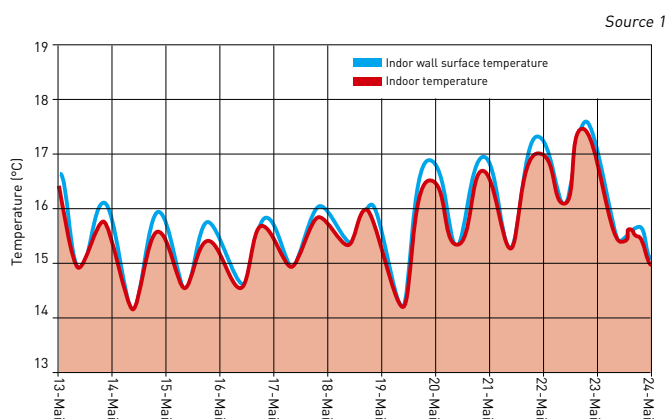


Source 1: University of Bath (UK), Dr. Mike Laurence

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

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.



Source 1

The value of the impact is proportional to the thickness of the bar	Optimal zone
Bacteria	Optimal zone
Virus	
Fungi	
Mites	
Respiratory infections	
Allergic rhinitis and asthma	
Chemical interactions	
Ozone emission	
Relative humidity (%)	

Source: Stirling, E.M., Arundel, A., Sterling, T.D., 1985. Criteria for Human Exposure to Humidity in Occupied Buildings, ASHRAE Transactions, 91 (1), 611-622

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.

20 years

of research, trials and achievements

Perfectly cohesive

All Tradical® Hempcrete performance characteristics result from the development of hemp+lime blends (Chanvribat® + Tradical® PF 70/ Thermo or Tradical® PF 80 M/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

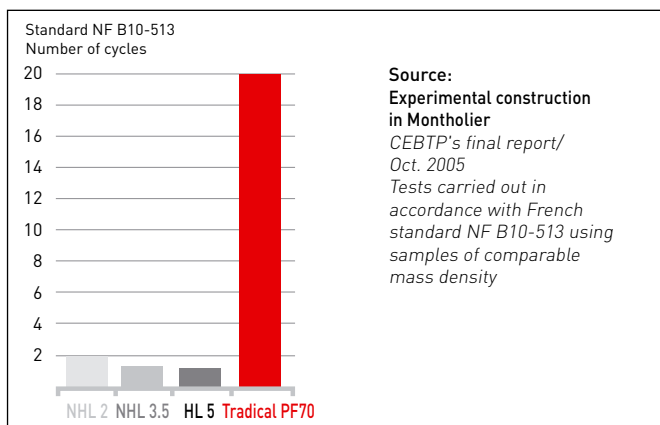
The excellent properties of Tradical® Hempcretes have made it a benchmark material used by many laboratories (ENTPE, CEBTP, UCL, CSTB, etc.) in studies conducted as part of R&D as well as in experimental construction projects.

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.

Durability

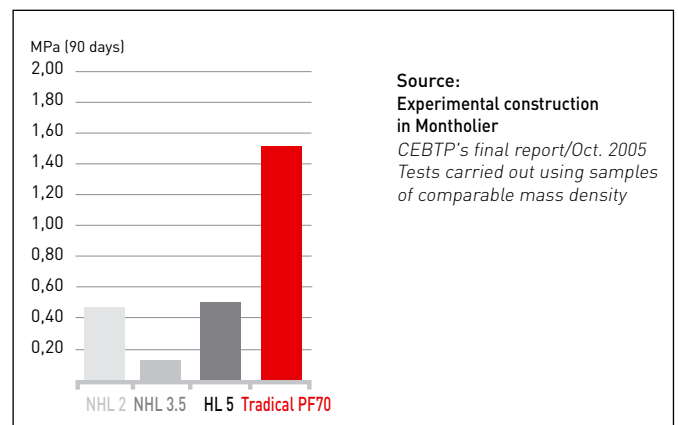
Tradical® Hempcretes have an excellent cohesiveness that enables them to achieve good results in the freeze-thaw test, despite their low mass density (< 500 kg/m³). Hempcretes prepared with various hydraulic limes (NHL and HL) did not withstand more than two cycles. Tradical® Hempcrete withstood **20 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.



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**

A high-performance material blend

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

R_w	C	C_{tr}
36 (-1;-5) dB	35.7 dB(A)	31.1 dB(A)

1 raw side - 1 side with 12.5 mm storey-high panel BBRI (Belgian Building Research Institute) report for test no. AC 4956

R_w	C	C_{tr}
49 (-1;-7) dB	48.5 dB(A)	42.5 dB(A)

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

R_w	C	C_{tr}
51 (-2;-7) dB	50 dB(A)	44 dB(A)

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).

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



French Professional Rules for design and application

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

Radical[®], the first hempcretes to comply with French Professional Rules

Experience and reliability

The experience acquired both on construction sites and in laboratories has turned Radical[®] 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 Radical[®] 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] 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>

Insurability: 3 commitments made by Tradical®

1- Commitment to correct performance

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

→ *Hempcretes*

- Chanvribat® + Tradical® PF 70
- Chanvribat® + Tradical® THERMO

→ *Hemp renders*

- Chanvribat® + Tradical® PF 80 M
- Chanvribat® + Tradical® 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® Hempcretes as well as how to apply them within the fields covered by the regulation.

Training in a few figures

30 Training locations

8 Accredited trainers

No. of trainees **>1100**

Guarantee

The four Tradical® Hempcrete and Tradical® Hygrothermal Render blends benefit from a manufacturer's civil liability, SMABTP contract: ALPHA-BAT Fabricants no. 512806 E 1004.000



RESTORATION

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

Reference documents

(1) Order dated 03 May 2007

(2) Order dated 13 June 2008

(3) Value available in the reference document THU Ex, on the following website:

<http://www.rt-batiment.fr/batiments-existants>

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.

For the thermal improvement of *Existant par Element* (individual existing structural elements), each item can be dealt with point by point as the planned works progress.

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.yr
- More comfort in summer

Min. R for roof (slope < 60°) = 4 m².K/W

➔ **Solution – Tradical® Insulating roof**

- R = 4.1 with a thickness of 25 cm (Tradical® PF 70 + Chanvribat®)
 - R = 4.1 with a thickness of 23 cm (Tradical® Thermo + Chanvribat®)
- When the insulation installed leads to a > 5% reduction of living area, **R is decreased to 3 m².K/W**

Min. R for roof (slope > 60°) = 2.3 m².K/W

➔ **Solution – Tradical® Insulating roof**

- R = 2.3 with a thickness of 13 cm (Tradical® PF 70 + Chanvribat®)
 - R = 2.3 with a thickness of 12 cm (Tradical® Thermo + Chanvribat®)
- When the insulation installed leads to a > 5% reduction of living area, **R is decreased to 2 m².K/W**

and successful insulation

Min. R for wall* = 2.3 m².K/W

➔ **Solution – Tradical® Insulating lining**

- R = 2.35 with a thickness of 20 cm (Tradical® PF 70 + Chanvribat®)
- R = 2.35 with a thickness of 18 cm (Tradical® Thermo + Chanvribat®)

Example: A rubble stone wall renovation with insulation applied on the interior.

Take the existing performance into account:

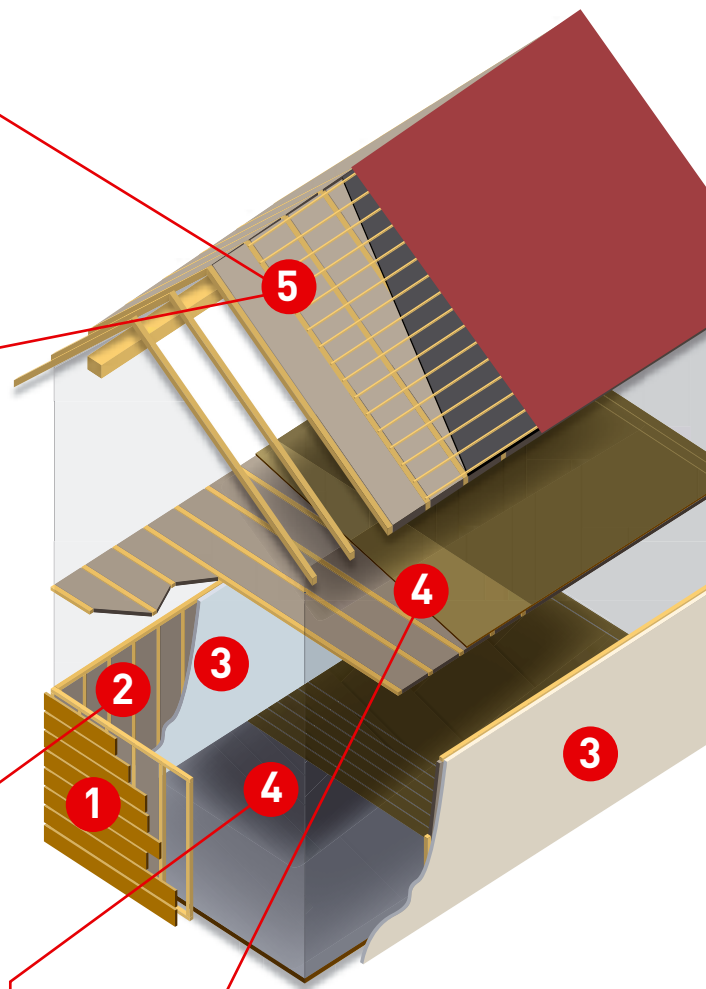
For a limestone wall⁽³⁾ with a λ of 1.7 W/(m.K) and a thickness of 50 cm, the interior Tradical® Hempcrete insulation is as follows:

R total = Existing R + Insulating lining R.

For R total = 2.3 and Existing R = 0.29 (or 0.50/1.7) Tradical® Hempcrete insulating lining R = 2.0

To comply with the French thermal regulations (RT), the Tradical® Hempcrete insulating lining must be 14 cm thick (using Tradical® Thermo)

**For housing in a French H3 climate zone at an altitude of < 800 m, R = 2 m².K/W. In this case, the lining is 13 cm thick.*



Min. R for floor in unused roof spaces = 4.5 m².K/W

➔ **Solution – Tradical® Insulating lining**

- R = 4.5 with a thickness of 27 cm (Tradical® PF 70 + Chanvribat®)
- R = 4.5 with a thickness of 25 cm (Tradical® Thermo + Chanvribat®)

Min. R for ground floor = 2 m².K/W

➔ **Solution – Tradical® Insulating screed**

- R = 2.1 with a thickness of 20 cm (Tradical® PF 70 + Chanvribat®)

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.

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.



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.

Reference documents

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

The RT 2012 regulation takes a three-pronged approach:

Energy efficiency of builds

This is defined by the **Bbiomax** coefficient (thebioclimatic 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.

*For the time being, Cepmax for collective housing is < 57 kWh/(m².yr)

Summer comfort in buildings without air conditioning

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

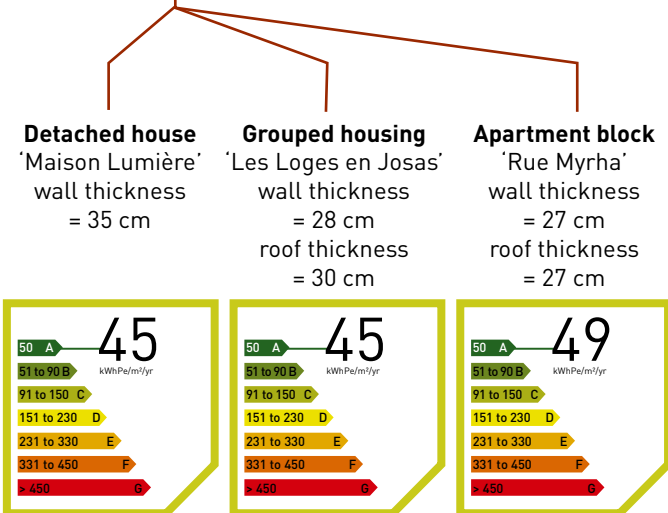
Successful designs

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).

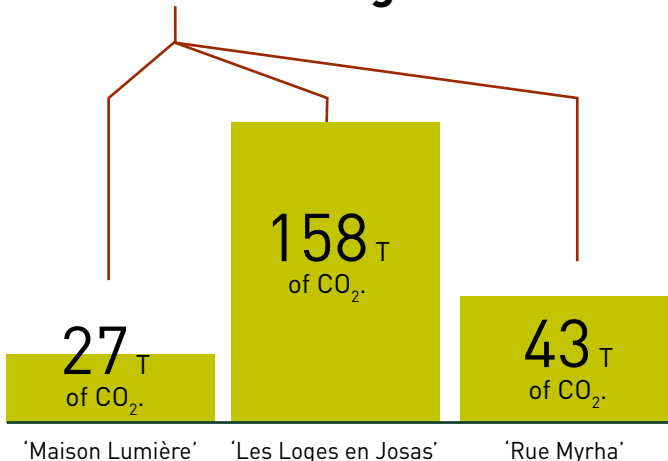
Tradical® Hempcrete is perfect for this type of building design, with its easy to manage thicknesses and solutions for walls, floors and roofs.

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

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



Carbon Storage Environmental impact



Getting the best comfort for the summer

The various thicknesses of Tradical® Hempcrete structures handle **summer comfort** and winter 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 (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'



Restoring and Innovating

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.

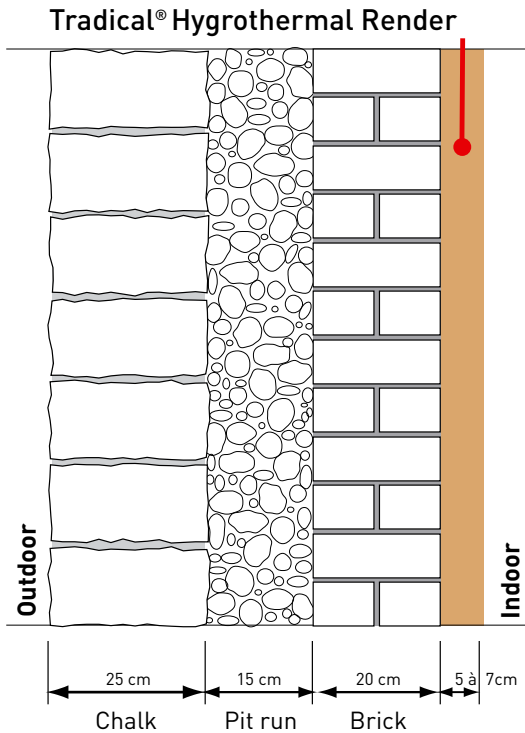
The local sourcing of timber and hemp was a priority and led the main contractor to opt for a hygrothermal render solution for the interior vertical walls.

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.

Public building: Maison Diocésaine – Chalons en Champagne - France



Vertical wall section

THE PROJECT

Location
Châlons-en-Champagne - France

Type of building work

Renovation/Transformation of a public building to include an exhibition space, open-plan offices, meeting rooms, resource rooms, and staff accommodation.

PROJECT ACTORS

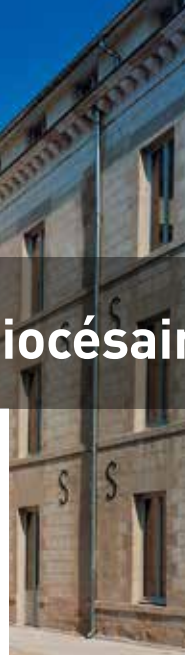
Project owner
Diocesan Association
of Châlons-en-Champagne (France)

Main contractor
• Méandre, architects

Thermal design engineering
• MCI THERMIQUES

Manufacturer, designer and supplier of Tradical®
Hygrothermal render
• BCB-Tradical®

Delivered: 2004



Natural self-insulation system

1550 m²

Hygrothermal renders
Tradical® PF 80 M +
Chanvribat®

Performance of the envelope

Hygrothermal render

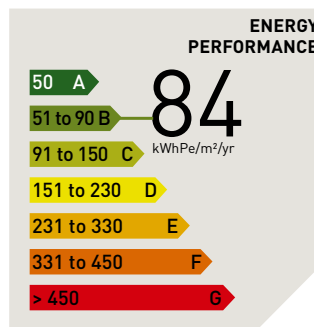
$R = 0.47 \text{ m}^2 \cdot \text{K/W}$
 $\lambda = 0.17 \text{ W/m} \cdot \text{K}$
Thickness = 8 cm

Stone walls

$R \text{ total} = 1.19 \text{ m}^2 \cdot \text{K/W}$
Floor 0 to 2 + Floor 3 in part
($R \text{ total} = R \text{ of chalk}$
+ $R \text{ for pit run}$
+ $R \text{ of medium density clay brick}$
+ $R \text{ of hemp/lime render}$)

Brick walls

$R \text{ total} = 1.07 \text{ m}^2 \cdot \text{K/W}$
Floor 3 to height of openings
($R \text{ total} = R \text{ of lime render}$
+ $R \text{ for hollow clay brick}$
+ $R \text{ of hemp/lime render}$)



SHON (net floor area)
1650 m²



Restoring and Innovating

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.

Public building: Maison du Tourisme - Ville de Troyes - France

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

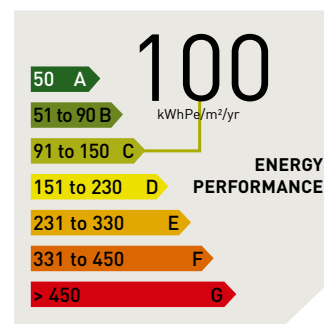
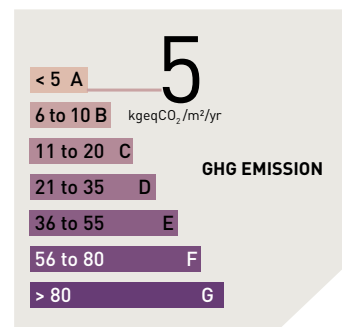
- LEON NOEL

Manufacturer, designer and supplier of

- Tradical® Hempcrete
- BCB-Tradical®

Delivered

2nd quarter in 2013



Performance was improved compared to the situation before restoration

GHG emission

84% improvement

Energy performance

51% increase

Net floor area (SHON)
712 m²

Net floor area (SHON)
created
302 m²

Height of the building
14.80 m (Ground floor
+ 2 floors + attic)

Natural self-insulation system

645 m²

Hempcrete made with Tradical® PF 70 + Chanvribat®

Performance of the envelope

Half-timbered walls (305 m²)

$R = 3.53 \text{ m}^2 \cdot \text{K/W}$

$\lambda = 0.085 \text{ W/m.k}$

Thickness = 30 cm

Roof insulation (340 m²)

$R = 5 \text{ m}^2 \cdot \text{K/W}$

$\lambda = 0.06 \text{ W/m.k}$

Thickness = 30 cm



Building and Innovating

PROJECT ACTORS

Project owner: Private individual

Main contractor

• Yann Roïnnel, architect
11 place St Pierre - 28000 Chartres - France
www.a-sphère.architecte.com

Hempcrete application

• ACEIS
ZA la Biardel - 35520 - La Mézière - France

Manufacturer, designer and supplier of Tradical® Hempcrete

• BCB-Tradical®

Delivered: 1st quarter in 2011



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 fulfil 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.

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®

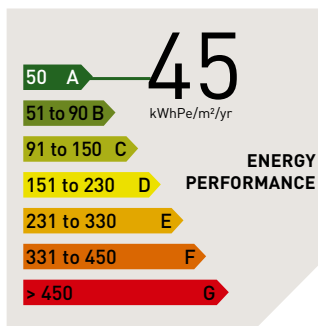
Facade wall

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

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.

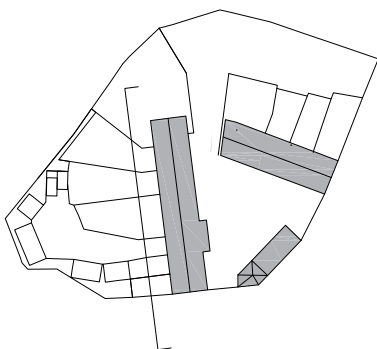
Preserving the identity of the location

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 Ile 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.



Grouped housing - Les Loges-en-Josas - France



THE PROJECT

Location

Rue de la Folie
Les Loges en Josas, France

Type of building work

Construction of 10 houses
grouped together

PROJECT ACTORS

Project owner:

SCI Vallée de la Bièvre

Main contractor

• DLA Dumont-Legrand, architects
1 rue du Lieuvain - 75015 Paris - France
www.dumont-legrand.fr

• LM Ingénieur

Design Engineering - Structure/Envelope/
Environment

13 rue Chapon - 75003 Paris - France

General contractor

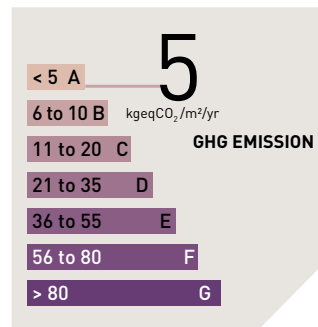
• JR BAT

Manufacturer, designer and supplier
of Tradical® Hempcrete

• BCB-Tradical®

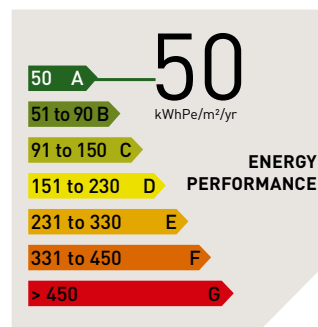
Delivered

1st quarter in 2015



Performance of the envelope

Rated French
low-energy new
building (BBC Neuf)



Natural self-insulation system

552 m³

Hempcrete made with
Tradical® PF 70 +
Chanvribat®

Insulating wall

900 m²

R = **3.3** m².K/W

λ = 0.085 W/m.k

Thickness = 28 cm

Insulating roof

1000 m²

R = **5** m².K/W

λ = 0.06 W/m.k

Thickness = 30 cm

Design highlights

- Solar hot water
- Masonry stove
- Natural ventilation

DLA DUMONT
LEGRAND
ARCHITECTES

LM Ingénieur





Building and Innovating



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

Tradical® hempcrete is an ultralight concrete at 330 kg/m³ compared with 2.23 t/m³ for reinforced concrete.

This was a huge advantage for the Paris site as it enabled the NORTH BY NORTHWEST architects and the 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.

Apartment block - Social housing - Paris 18th district - France

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 (NXNW), architects
42 Rue d'Avron, 75020 Paris, France
www.nxnw.fr

- LM Ingénieur
Design Engineering - Structure/Envelope/Environment
13 rue Chapon - 75003 Paris - France

- MDETC (budget specialist)

General contractor

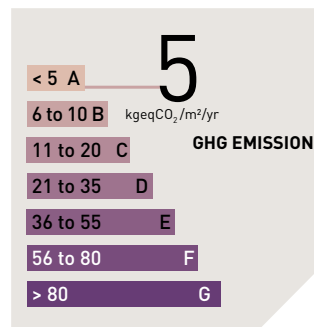
- TEMPERE CONSTRUCTION

Manufacturer, designer and supplier of Tradical® Hempcrete

- BCB-Tradical®

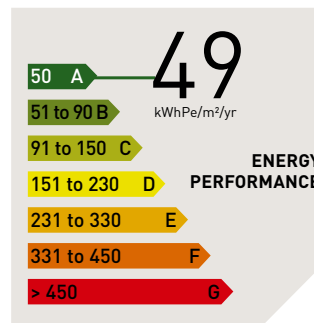
Delivered

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

$R = 3.17 \text{ m}^2 \cdot \text{K/W}$
 $\lambda = 0.085 \text{ W/m.k}$
Thickness = 27 cm

Roof

$R = 4.5 \text{ m}^2 \cdot \text{K/W}$
 $\lambda = 0.06 \text{ W/m.k}$
Thickness = 27 cm

Surface area of the building
570 m² (SHON)

Surface area of apartments
345.78 m²

Height of the building
Ground floor + 5 floors
(with setback)

Depth of the infrastructure: 3 m
Injection to 40 m

Design highlights

- Solar hot water
- Rainwater harvesting

Acoustic performance

40 dB between apartments and shared spaces
53 dB between apartments

CLASSIFICATION of

Accredited Hemp/Lime blends

Test reports concerning the mechanical characteristics of hempcretes and hemp renders

Roof insulation

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

Floor Insulation

- CRDA test no. 2013-18 report: BCB Tradical® Thermo+Chanvribat® screed formula dated 10/07/2014
- ENTPE report dated 05/06/2013: Tradical® PF 70 + Chanvribat® screed

Wall Application

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

Render Application

- CRDA test no. 2013-17 report: BCB-Eurochanvre Tradical® Thermo+Chanvribat® render formula dated 04/12/2013
- CRDA test no. 2014-07-02 report: 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 Fabricants no. 512806 E 1004.000



Tradical® PF 70

Product description

- Class FL A 3.5 air lime according to standard NF EN 459.
- Lime for standard Tradical® Hempcrete applications

Technical data

Ingredients

Air lime with 98% Ca(OH) ₂	80%
Hydraulic binder	20%

Apparent mass density

0.65

Packaging

22 kg paper bag on 50-bag pallet

Weight of one pallet

1100 kg

Pallet dimensions

H x L x W = 150 x 90 x 110

Storage

Unexposed and dry




Lime and Hemp



Hempcrete range

Hemp render range

Tradical® ZHERMO		Chanvribat®		Tradical® PF 80 M		Tradical® Bâtir	
<ul style="list-style-type: none"> Class FL A 3.5 air lime according to standard NF EN 459. Lime for standard Tradical® Hempcrete applications 		<ul style="list-style-type: none"> A natural, sound, 'breathing', plant-based aggregate, which is <i>Granulat Chanvre Bâtiment</i> certified. Made from hemp, an annual plant grown in France without any phytosanitary treatment. Easily renewable material. Manufacturing is mechanical, uses very little energy and no toxic materials. 		<ul style="list-style-type: none"> Formulated air lime with a mineral content enabling aggregate coating and bonding. This white lime is used with Chanvribat® to prepare a hygrothermal render with a creamy finishing texture. 		<ul style="list-style-type: none"> Class FL A 3.5 air lime according to standard NF EN 459. This white lime is used with Chanvribat® to prepare a hygrothermal render with a standard finishing texture. 	
Air lime with 98% Ca(OH) ₂	75%			Mineral fillers unfired limestone (CaCO ₃) with well-graded particle size distribution	35%	Air lime with 98% Ca(OH) ₂	80%
Hydraulic binder	25%			TRADICAL® PF 80 binder -Air lime with à 98% of Ca(OH) ₂	65%	Hydraulic binder	20%
		Approx. 100 kg/m ³					
		20 kg bag = approx. 200 litres net volume (broken up)					
		420 kg					
		H x L x W = 240 x 80 x 120 cm					
		Unexposed and dry					
0.56				0.85		0.61	
18 kg paper bag on 60-bag pallet				30 kg paper bag on 40-bag pallet		20 kg paper bag on 50-bag pallet	
1080 kg				1200 kg		1000 kg	
H x L x W = 150 x 90 x 110				H x L x W = 150 x 90 x 110		H x L x W = 110 x 120 x 110	
Unexposed and dry				Unexposed and dry		Unexposed and dry	



CLASSIFICATION of

The λ for **Chanvribat® + Tradical® Thermo** material blends h

INSULATING WALL and INSULATING LINING

applied between wall and shuttering



1 Chanvribat® +
2 Tradical® PF70



1 Chanvribat® +
2 Tradical® THERMO

CHARACTERISTICS		
Concrete mixed at	220 kg/m ³	180 kg/m ³
Mass density	320 kg/m ³	280 kg/m ³
Thermal conductivity	$\lambda = 0.085$ W/m.k	$\lambda = 0.076$ W/m.k
Compression strength (at 90 days)	0.9 MPa	0.7 MPa

THERMAL PERFORMANCE RATINGS		
15-cm-thick wall	R = 1.8	R = 2.0
20-cm-thick wall	R = 2.4	R = 2.6
25-cm-thick wall	R = 2.9	R = 3.3
30-cm-thick wall	R = 3.5	R = 4.0
35-cm-thick wall	R = 4.1	R = 4.6
40-cm-thick wall	R = 4.7	R = 5.3

R in (m².K/W)

INSULATING WALL LINING

applied by trowelling



1 Chanvribat® +
3 Tradical® PF70



1 Chanvribat® +
3 Tradical® THERMO

CHARACTERISTICS		
Concrete mixed at	330 kg/m ³	270 kg/m ³
Mass density	430 kg/m ³	370 kg/m ³
Thermal conductivity	$\lambda = 0.107$ W/m.k	$\lambda = 0.092$ W/m.k

THERMAL PERFORMANCE RATINGS		
10-cm-thick lining	R = 0.9	R = 1.09
15-cm-thick lining	R = 1.4	R = 1.63
20-cm-thick lining	R = 1.9	R = 2.17
25-cm-thick lining	R = 2.3	R = 2.72

R in (m².K/W)

Certification

Hemp/Lime blends Tradical® Thermo + Chanvribat® and Tradical® Bâtir + Chanvribat® have been measured for thermal performance in COFRAC-certified laboratories:

Insulating walls and insulating linings

CODEM test dated 05/06/2014
Test report: AF0314AC-004/
ref. ECO414AC-002A

Hygrothermal renders

CODEM test dated 18/08/2016
Test report: RE0816BL-001/
ref. ER16-042-i1

Insulating roofs and unused roof space

CODEM test dated 05/06/2014
Test report: AF0314AC-004/
ref. ECO414AC-001A

HYGROTHERMAL RENDER



1 Chanvribat® +
5.5 Tradical® PF 80 M



1 Chanvribat® +
4 Tradical® BÂTIR

CHARACTERISTICS		
Concrete mixed at	825 kg/m ³	400 kg/m ³
Mass density	925 kg/m ³	500 kg/m ³
Thermal conductivity	$\lambda = 0.17$ W/m.k	$\lambda = 0.14$ W/m.k

THERMAL PERFORMANCE RATINGS		
3-cm-thick render	R = 0.17	R = 0.21
5-cm-thick render	R = 0.29	R = 0.36
8-cm-thick render	R = 0.47	R = 0.57

R in (m².K/W)

Thermal performance ratings

have been tested in **COFRAC-certified** laboratories

INSULATING SCREED



1 Chanvribat® +
2.5 Tradical® PF70



1 Chanvribat® +
2.5 Tradical® THERMO

CHARACTERISTICS

Concrete mixed at	275 kg/m ³	225 kg/m ³
Mass density	375 kg/m ³	325 kg/m ³
Thermal conductivity	$\lambda = 0.096$ W/m.k	$\lambda = 0.084$ W/m.k
Compression strength (at 90 days)	1.1 MPa	0.55 MPa

THERMAL PERFORMANCE RATINGS

10-cm-thick screed	R = 1.0	R = 1.2
15-cm-thick screed	R = 1.6	R = 1.8
20-cm-thick screed	R = 2.1	R = 2.4
25-cm-thick screed	R = 2.6	R = 3.0

R in (m².K/W)

INSULATING ROOF and UNUSED ROOF SPACE



1 Chanvribat® +
1 Tradical® PF70



1 Chanvribat® +
1 Tradical® THERMO

CHARACTERISTICS

Concrete mixed at	110 kg/m ³	90 kg/m ³
Mass density	210 kg/m ³	190 kg/m ³
Thermal conductivity	$\lambda = 0.06$ W/m.k	$\lambda = 0.056$ W/m.k

THERMAL PERFORMANCE RATINGS

20-cm-thick insulation	R = 3.3	R = 3.6
25-cm-thick insulation	R = 4.1	R = 4.5
30-cm-thick insulation	R = 5	R = 5.4
35-cm-thick insulation	R = 5.8	R = 6.3

R in (m².K/W)

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).

Protecting insulating walls

Half-timbering, embedded framing and lining walls

INTERIOR

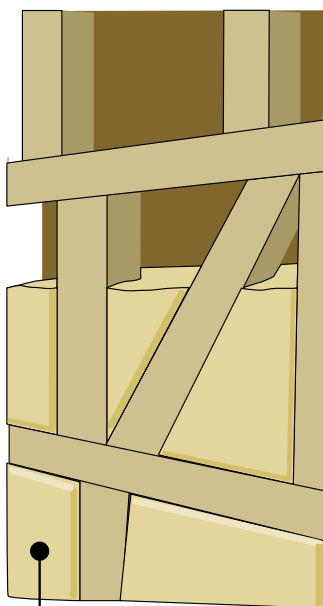
Once the lining has dried evenly (drying time – about 1 week for 2 cm) and depending on the evenness of the surface, apply either of the following:

- 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

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.

(In all cases, refer to the corresponding technical data sheets).



Insulating filling
Tradical® PF 70 + Chanvribat®
Tradical® Thermo + Chanvribat®
 Base coat and Brown coat
Tradical® PF 70 + sand
 or **Tradical Bâtir + sand**
 Finishing render
Tradical® PF 80 + sand







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.

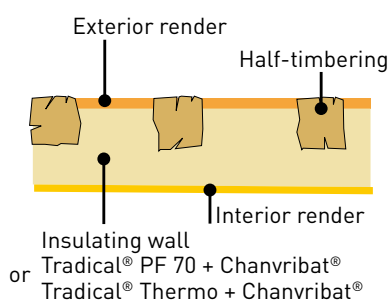
Mix proportions for 200 l of Tradical® Hempcrete

Water	Lime	Hemp aggregate for building
 60 to 70 L	+ 2 bags = 44 kg 	+ 1 bag 
or		
 60 L	+ 2 bags = 36 kg 	+ 1 bag 

Application

Complies with the French Professional Rules for the Construction of Hempcrete Structures: Insulating wall.

- **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.).

Insulating walls - Half-timbering



Compliant with French Professional Rules

Tradical® Hempcretes

- Tradical® PF70 + Chanvribat®
- Tradical® Thermo + Chanvribat®

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

Highlights

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.

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

Notes:

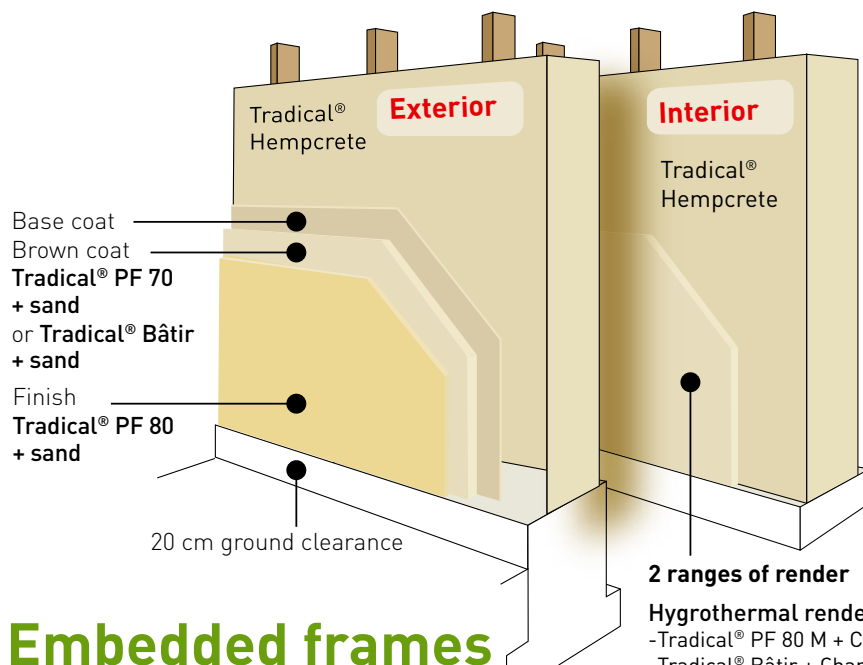
Walls made of Tradical® Hempcrete provide an insulating function. The structure must be self-supporting. Therefore, it is not appropriate to overlay any insulation, which would be detrimental to the continuity of the structure.

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



Mechanical application

Please contact us



Embedded frames

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

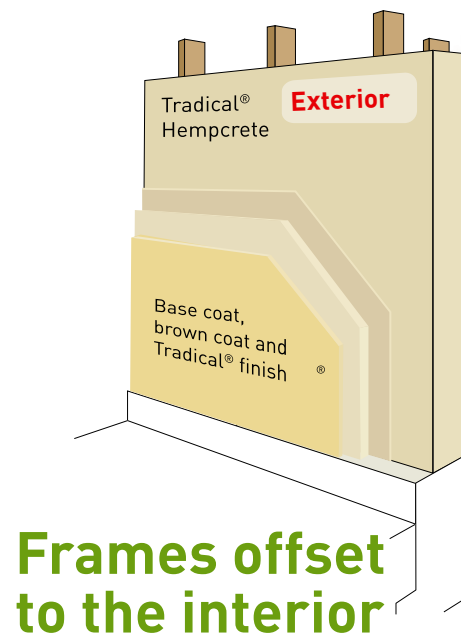
Mix until the mixture is homogeneous, making sure to avoid excessive mixing.

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

Mix proportions

for 200 l of Tradical® Hempcrete

Water	Lime	Hemp aggregate for building
60 to 70 L	2 bags = 44 kg Tradical® PF 70	1 bag Chanvribat
60 L	2 bags = 36 kg Tradical® Thermo	1 bag Chanvribat



Frames offset to the interior

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.

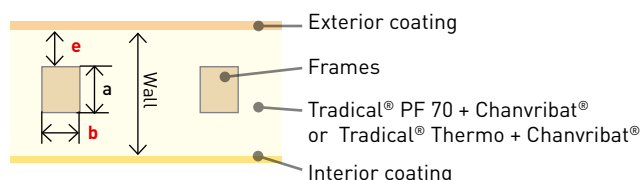
*The moisture transfer property of the hempcrete wall must be preserved.

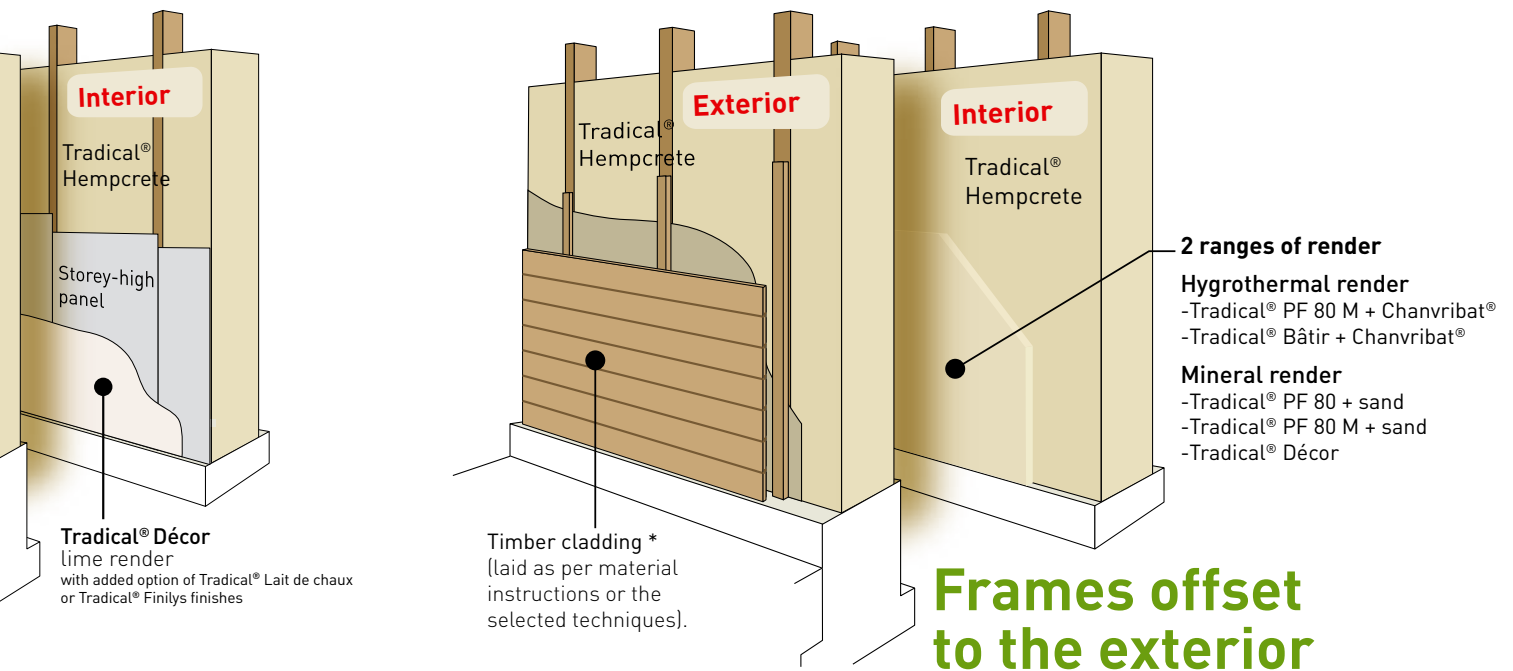
Coating the timber

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

Frame thickness b	4 cm	5 cm	6 cm	7 cm	8 cm
Minimum coating e	7 cm	7.5 cm	8 cm	8.5 cm	9 cm





Insulating walls - Embedded framing



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

Highlights

Works

They are used to create lightweight and high-performance insulating walls combined with a load-bearing framework (timber, metal, etc.). Depending on the project, this framework can be embedded or offset towards the interior or exterior.

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.



Mechanical application:
Please contact us



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

Water		Lime		Hemp aggregate for building
60 to 70 L	+	2 bags = 44 kg	+	1 bag Chanvribat
or				
60 L	+	2 bags = 36 kg	+	1 bag Chanvribat

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

Water		Lime		Hemp aggregate for building
60 to 70 L	+	2 bags = 44 kg	+	1 bag Chanvribat
or				
60 L	+	2 bags = 36 kg	+	1 bag Chanvribat



Insulating lining

Interior

Compliant with French Professional Rules

Tradical® Hempcretes enable you to apply an insulating lining on interior walls and partitions.

Highlights

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

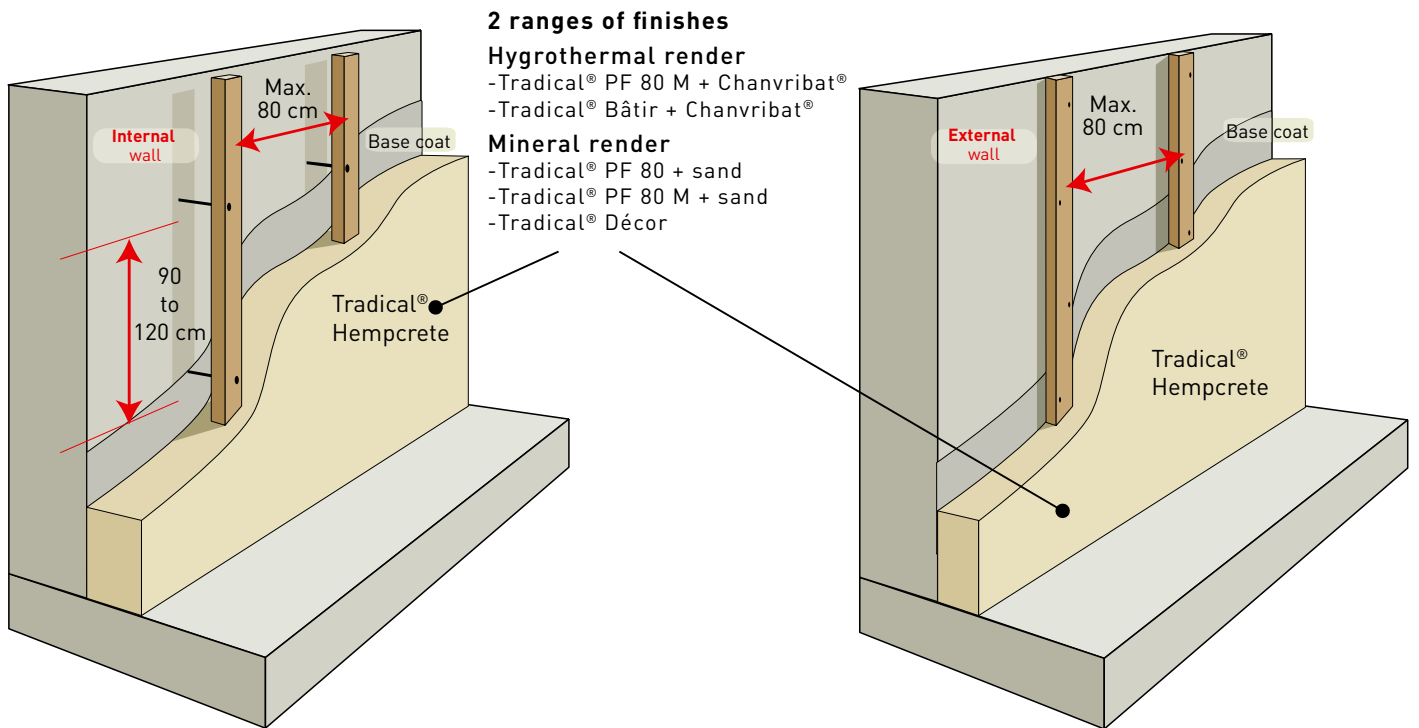
Performance

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



Mechanical application
Please contact us

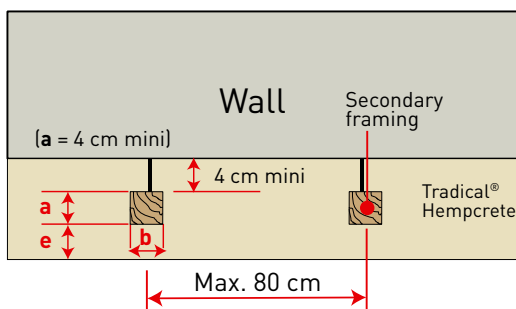


Thick lining

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.

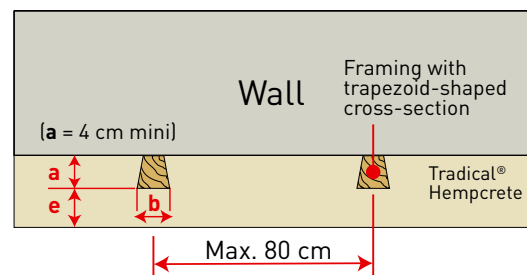


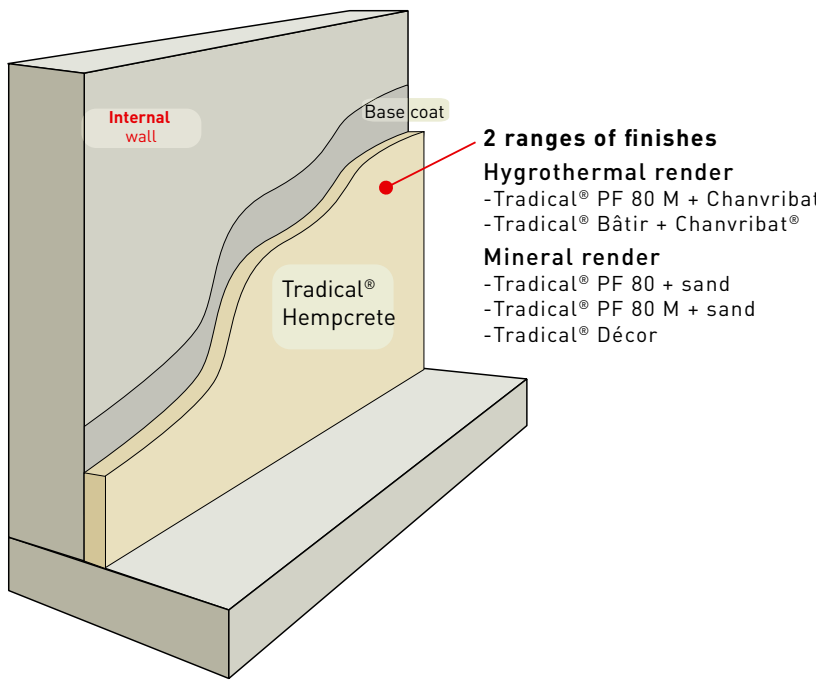
Medium lining

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.

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.

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

Frame thickness b	4 cm	5 cm	6 cm	7 cm	8 cm
Minimum coating e	7 cm	7.5 cm	8 cm	8.5 cm	9 cm

Base coat for insulating linings:

or $\frac{1 \text{ bag of Tradical® PF 70} + 60 \text{ l of 0/4 sand}}{\text{with Tradical® Thermo} + 50 \text{ to } 60 \text{ l of 0/4 sand}}$

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.

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 – CHANVRIBAT®: 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.

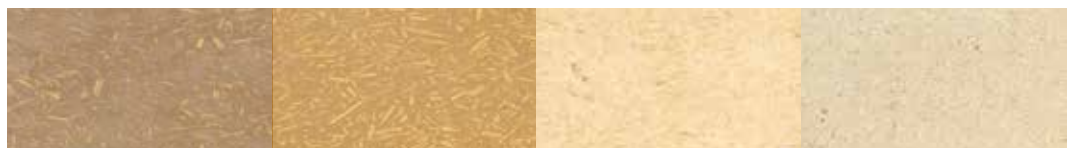
The mortar can be used immediately, but it will be easier to use after letting it rest for about 5 min (better adherence).

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

	Water		Lime		Hemp aggregate for building		
or	100 to 110 L	+	5.5 bags =165 kg		+	1 bag	
	100 to 110 L	+	4 bags =80 kg		+	1 bag	

Example of hygrothermal render colours





Hygrothermal renders

Interiors and exteriors

Compliant with French Professional Rules

The Tradical® Hygrothermal render meets the requirements of the French Professional Rules for the Construction of Hemp Mortar and Hempcrete Structures: Render Application, and is used within the scope of this document.

Highlights

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

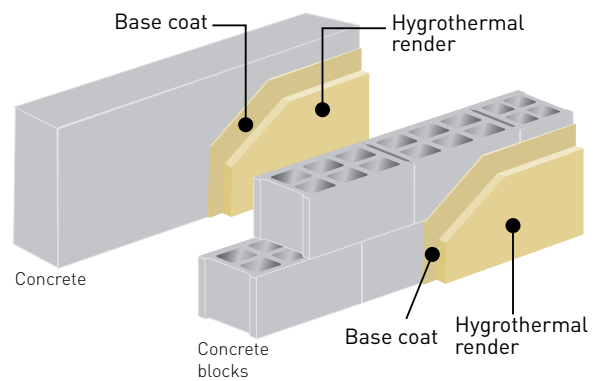
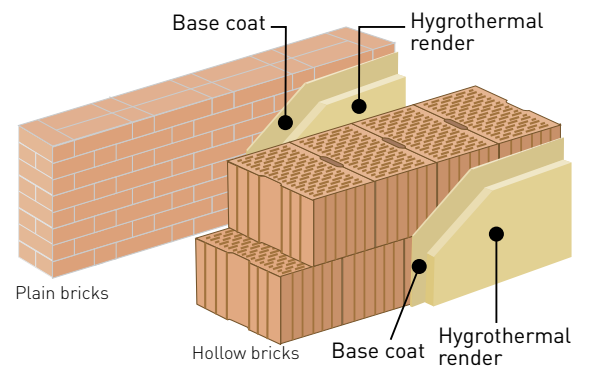
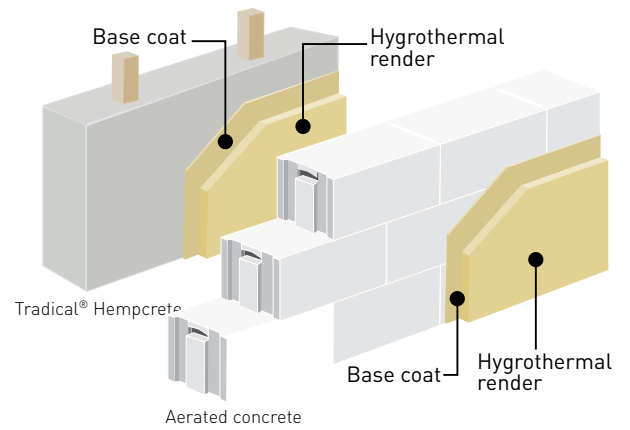


Mechanical application:

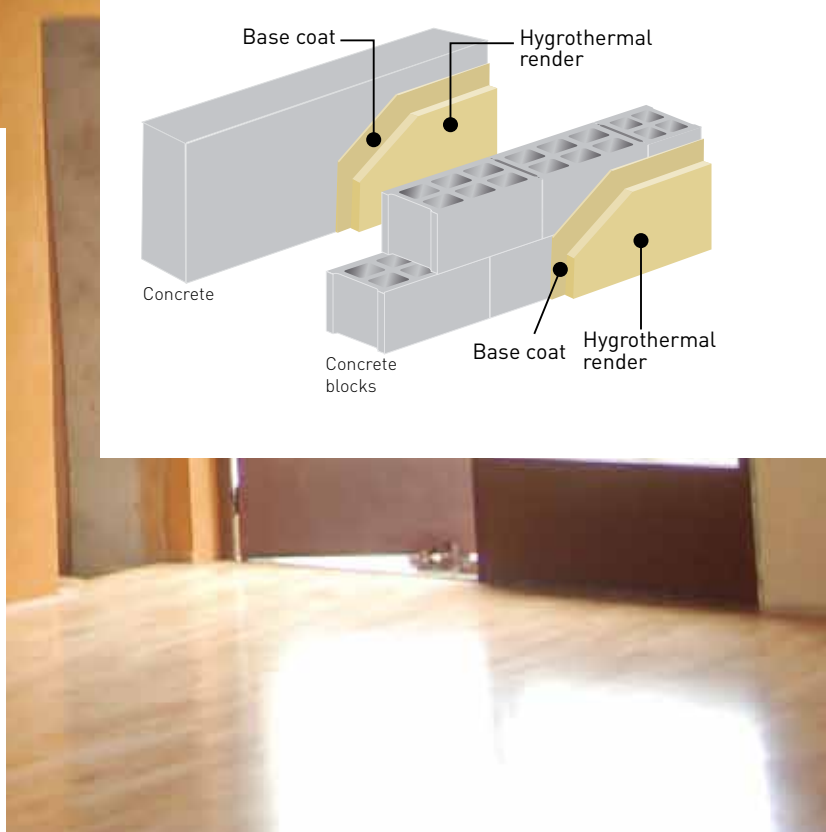
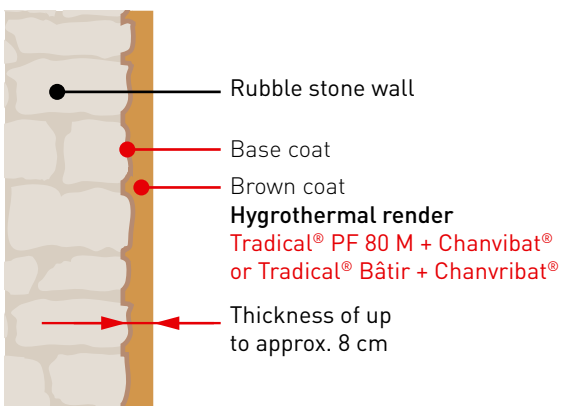
Please contact us



Substrates with a smooth surface



Masonry units laid with hollow joints



Hygrothermal renders

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 applied '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
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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

Water		Lime		Hemp aggregate for building
 80 to 100 L	+	2.5 bags = 55 kg	 +	1 bag 
or				
 80 to 100 L	+	2.5 bags = 45 kg	 +	1 bag 

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.

Highlights

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.

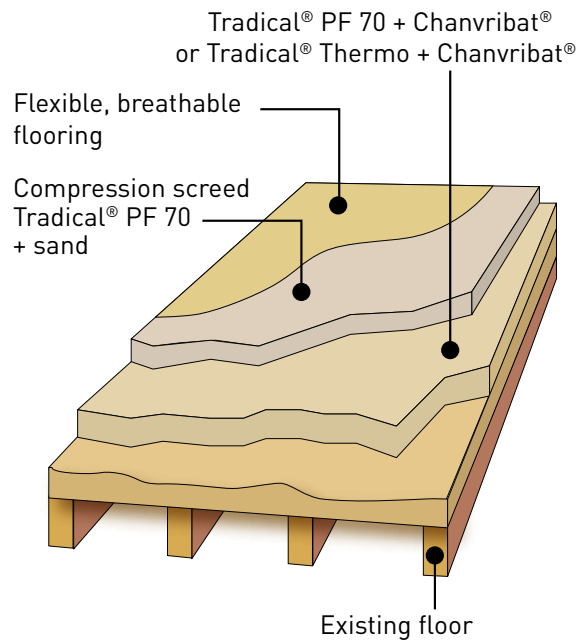


Mechanical application:
Please contact us



Flexible flooring

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

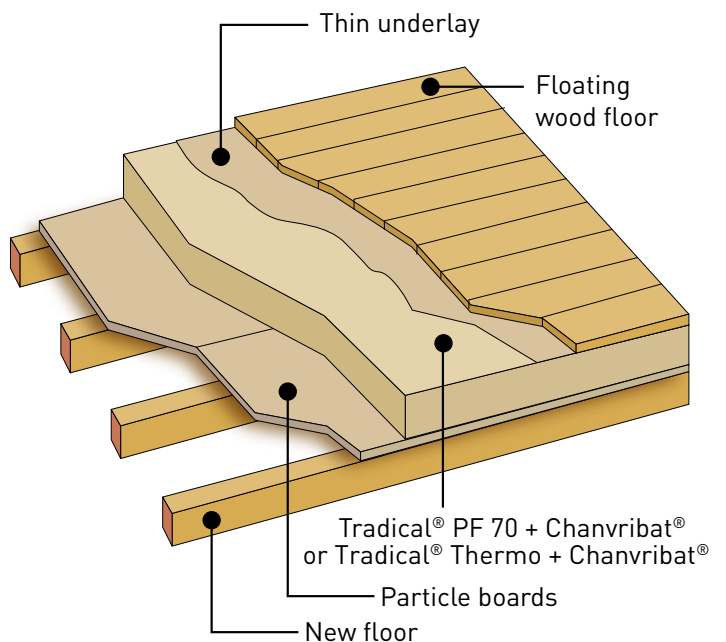


Insulating screeds – Gr

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.

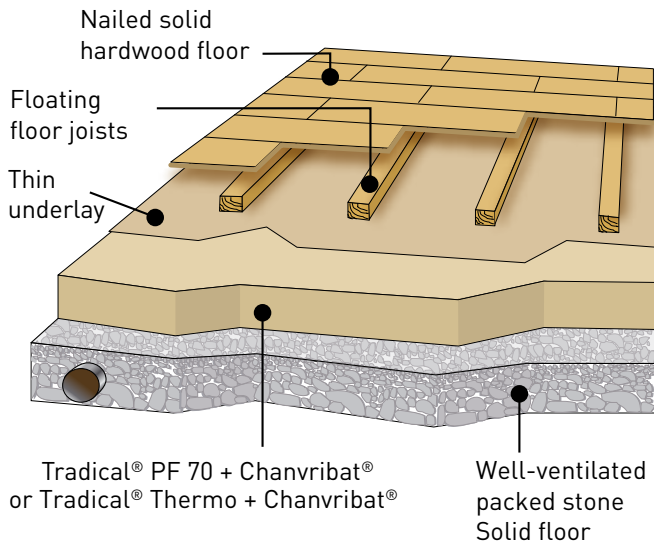
Note: Flooring with insufficient compression strength must be installed on a compression screed.



The four ranges of finishes shown below can be applied

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.



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).

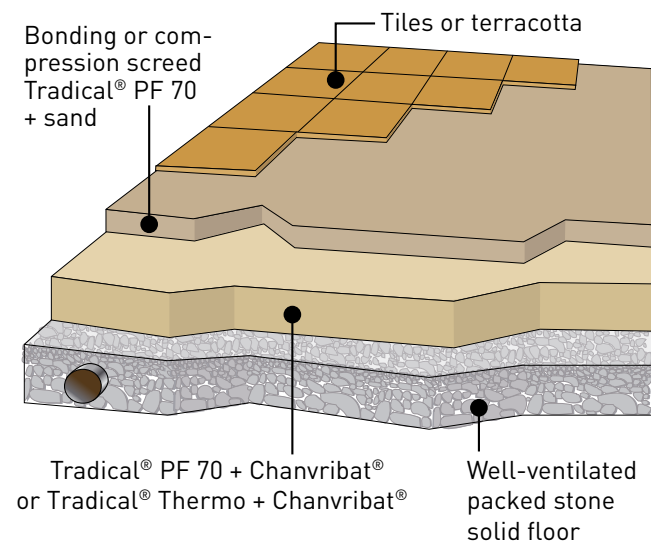
ground and floor

Cemented floor tiles

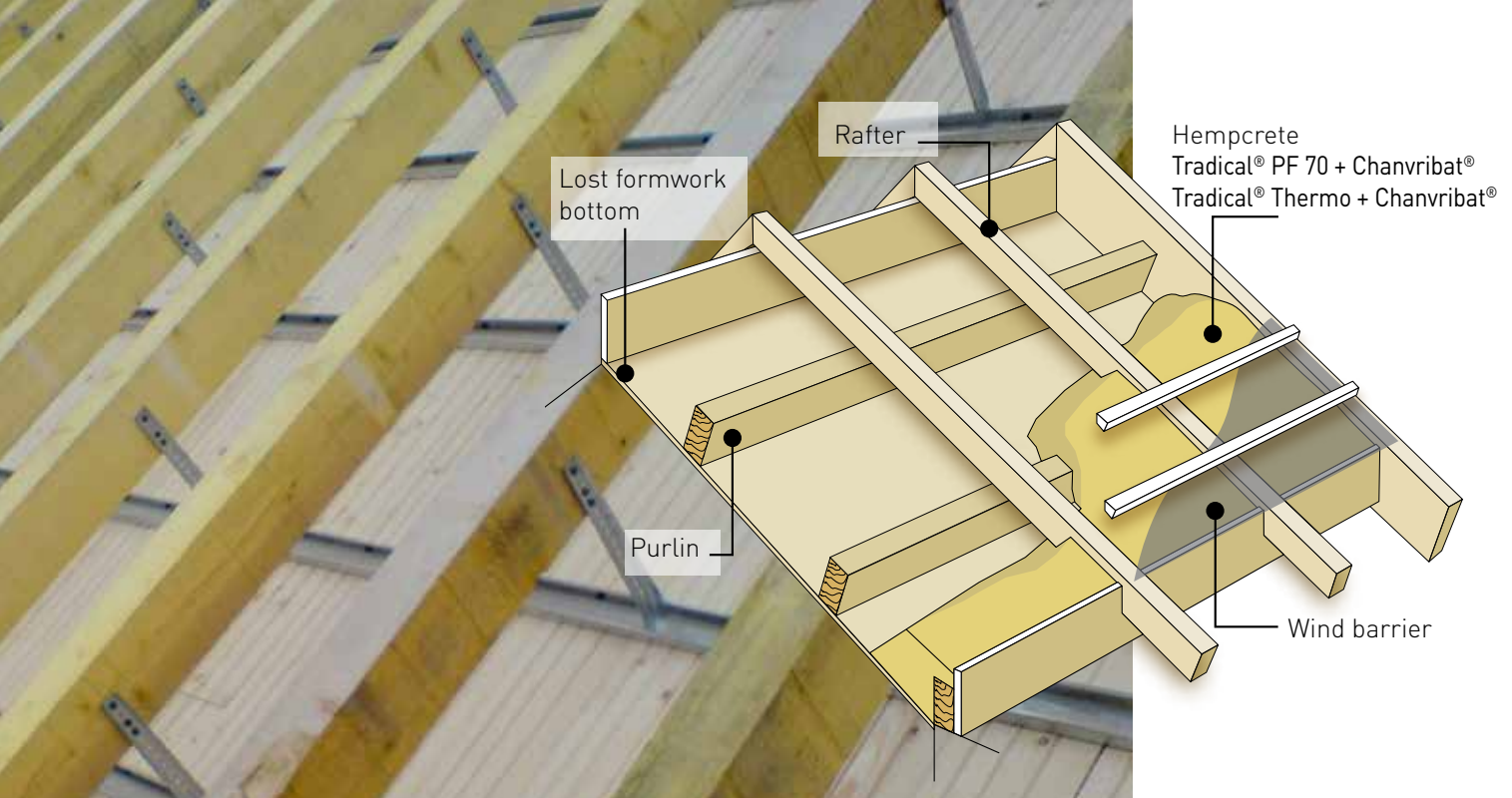
on a Tradical® PF 70 compression screed + sand 3 to 4 cm thick.

Cemented terracotta tiles

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



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

Water		Lime		Hemp aggregate for building
40 to 50 L	+	1 bag = 22 kg	+	1 bag
or				
43 L	+	1 bag = 18 kg	+	1 bag

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



Insulating roof and unused roof space

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.

Highlights

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

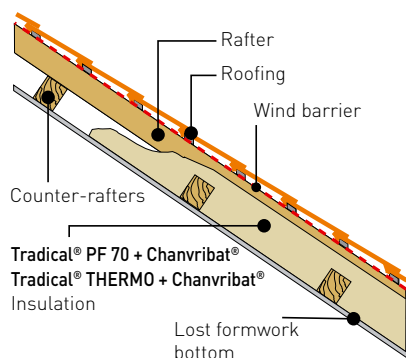
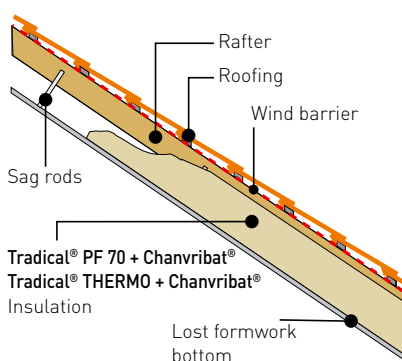
Characteristics

210 kg/m³ with Tradical® PF 70

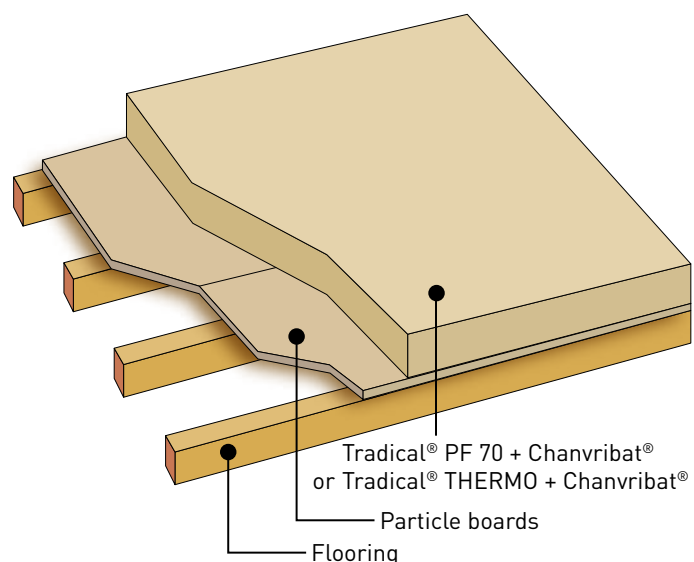
190 kg/m³ with Tradical® Thermo

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.



Floor in unused roof space





Air lime

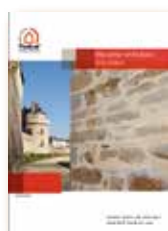
Air lime is produced by firing the purest limestone to 900°C.

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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