

INSTALLATION MANUAL

TECNO CANAPA

NATURAL BUILDING





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NATURAL BUILDING OF HEMP AND LIME

The construction industry is a major contributor to the overexploitation of land, energy, and resources. It is also a source of toxic emissions that may cause disease. For several years it has been going through a deep crisis closely related to the lack of balance between the social, environmental, and economic aspects of building and living, with obvious consequences including building speculation, sick building syndrome and poor quality of building materials.

Senini promotes an alternative development model capable of transforming the problem into a solution by creating building envelopes with natural materials, such as Hemp and Lime, which have a positive impact on the environment and maximise healthiness, comfort, energy efficiency and wellbeing for inhabitants.

The hemp plant has several interesting properties from an environmental point of view. It grows at any latitude to four/six meters high in four months. It does not require pesticides, herbicides or fertilisers. It regenerates the soil by providing nutrients, and captures large amounts of CO₂ from the atmosphere that will then be stored in its inner woody core.

Lime is obtained by burning limestone at much lower temperatures than the ones necessary to produce cement. The function of lime is to mineralise the vegetable component protecting it from decomposition, burning or being attacked by insects and rodents.

CANAPULO - Hemp Shiv

Canapulo is the woody part of the plant. It comes from the transformation process of the stem: the fibres (bark) are removed by a mechanical separation process. The woody part is then shredded and refined by eliminating fibre and dust residues.

LEGANTE DOLOMITICO NATURALE - Natural Dolomitic Binder

Legante Dolomitico Naturale is an aerial binder of natural lime without chemical or cement additives, intended to produce the biocomposites of hemp and lime **Biomattone**® and **Bio Beton**®. Mixing **Legante Dolomitico Naturale** together with **Canapulo** ensures an excellent capacity of humidity regulation since **Canapulo** has inherent hygroscopic properties. **Legante Dolomitico Naturale** is used for the restoration of historic buildings, renovations, new buildings and for the emerging need to build 'Nearly Zero-Energy Buildings' known as NZEB.

BIOMATTONE®

Biomattone® is a unique material that combines insulation and thermal mass properties.

It is composed of hemp shiv (certified CenC), hydrated dolomitic lime and probiotics. Respecting the principles of social and environmental sustainability, it has all the characteristics required of a building material in line with sustainable development: high insulating capacity, low embodied energy and the ability to absorb CO₂ from the atmosphere. The main characteristics of buildings made with **Biomattone**® are thermal, acoustic and hygrometric comfort.

Biomattone® is permeable to water vapour, it is resistant to fire, frost, insects and rodents. It guarantees the absence of toxic fumes in case of fire.

The applications are many: insulation of the perimeter walls, in combination with a load-bearing structure in wood, steel or reinforced concrete; internal partitions; internal or external wall insulation systems.

Biomattone® is the solution to the needs of Neo-building and classic construction by offering high energy savings, combined with the sustainability of the materials and their components. This solution also keeps the essence of the current building culture since the material is compatible in shape and size, with the construction systems better known by professionals.

Although it has no structural characteristics, combined with a load-bearing structure, **Biomattone**® is effective in the construction of the building envelope in which it performs both the function of infill wall and insulating wall. The way we deliver, handle, store, cut and install the hemp blocks is practically identical compared to the one of classic building materials (except for a few adjustments due to the insulating and hygrometric management qualities of **Biomattone**®).



FEATURES AND PERFORMANCE

DIMENSIONS

Biomattone® is a prefabricated biocomposite made of hemp and lime that has the size of 20x50 cm and available in thicknesses of 8, 12, 25, 30, 36, 40, 50 cm.

MAIN FEATURES:

- Thermal, acoustic and hygrometric comfort: **Biomattone®** is permeable to water vapour (breathing capability);
- Fire-resistant and pest resistant;
- Absence of toxic fumes in case of fire;
- Low embodied energy;
- Recyclable.

TECHNICAL SPECIFICATIONS

NB. [height] +/- 1 cm	BA8	BA12	NEW BA20	BA25	BA30	BA36	NEW BA40	NEW BA50
Sizes - Length, Height, Thickness - cm	50x20x8	50x20x12	50x40x20	50x20x25	50x20x30	40x20x36	50x20x40	40x20x50
Density - Kg/m³ dry	310	310	310	310	310	310	310	310
Conductivity - W/mk LAMBDA λ	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044
Transmittance - W/m²K U	0,5	0,34	0,21	0,17	0,14	0,12	0,11	0,09
Total thermal resistance (Rt) - m²K/W	1,99	2,9	4,71	5,85	6,99	8,35	9,01	11,53
Thermal offset without plaster	3h 00'	5h 44'	11h 19'	14h 46'	18h 14'	22h 23'	25h 08'	32h 04'
Specific heat capacity - J/KgK	1280	1280	1280	1280	1280	1280	1280	1280
Vapour permeability - μ	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5
Sound absorption coefficient (aw)	1 - CLASS A	1 - CLASS A	1 - CLASS A	1 - CLASS A	1 - CLASS A	1 - CLASS A	1 - CLASS A	1 - CLASS A
Soundproofing index (Rw) - dB					40	42	43	45
Compressive strength - N/mm2	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
Shear traction with rawlplug - kN	2,067	2,067	2,067	2,067	2,067	2,067	2,067	2,067
Orthogonal traction with rawlplug - kN	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734
Reaction to fire with plaster	B - s1, d0	B - s1, d0	B - s1, d0	B - s1, d0	B - s1, d0	B - s1, d0	B - s1, d0	B - s1, d0
Fire resistance without plaster - min		EI60			EI180	EI180	EI180	EI180



BUILDING SITE

Biomattone® has optimised dimensions and can be handled easily which facilitates its storage and the installation. **Biomattone®** is about 3 times lighter than traditional bricks but has an insulation capacity comparable to synthetic insulating materials.

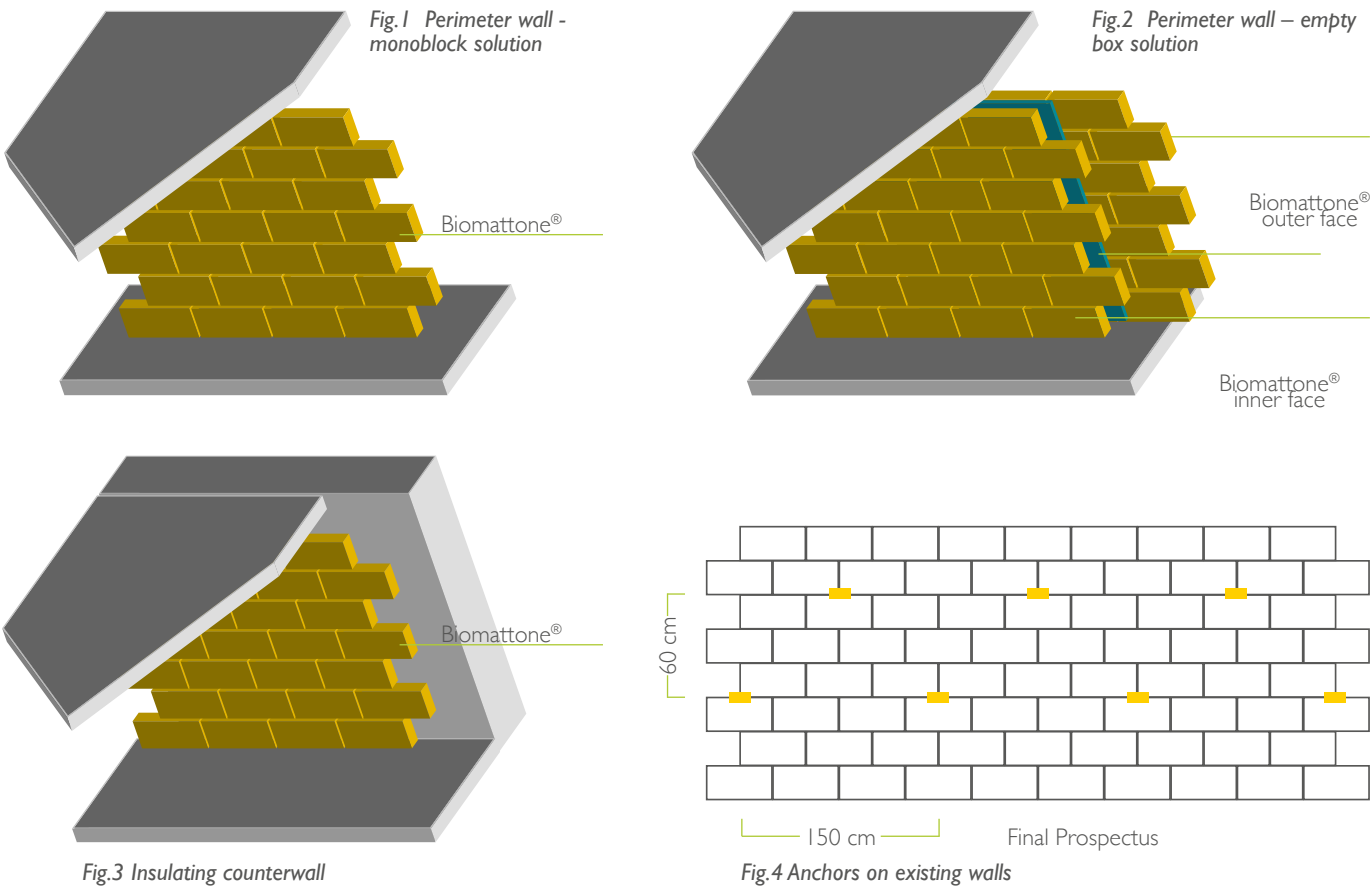
APPLICATIONS

PERIMETER WALL

Biomattone® can be used to build a perimeter insulating wall with the monoblock solution (fig. 1) or with the empty box solution, using several insulating layers.

EXISTING WALL

Biomattone® can be used as an insulating counterwall for existing walls as part of the energy requalification programs for buildings (fig. 3). Anchors are made by fixing L-brackets on the **Biomattone®**. The wing of the bracket fixed to the existing masonry must be at least 40mm long, the other part must be at least half the thickness of **Biomattone®**, the width must be at least 20mm. The fixation can be done with a 40mm rawlplug in the existing masonry and with a 60 mm nail (or screw) in the **Biomattone®**. The anchors must be laid every 150cm and every three courses of bricks in height, i.e. 60cm. (fig. 4)



APPLICATIONS

CAVITY WALL

A cavity can be created between the existing wall and the counterwall of **Biomattone®**. This solution is valid for both interiors and exteriors. It allows to uniform the surface and to reach high performance. The cavity can be filled with **Bio Beton®200 Pronto**, a low-density insulating material of hemp and lime.



Counterwall of Biomattone® with a cavity filled with Bio Beton®200 Pronto

PARTITION WALL

The installation of an internal partition increases the hygrothermal storage capacity and improves the indoor comfort and the acoustic performance.



Internal partition of Biomattone®

ROOF INSULATION

Bio Beton®200 Pronto can also be used for roof insulation in the presence of appropriate joists and decking.

APPLICATIONS

STORAGE AND HANDLING:

The delivery of **Biomattone®** takes place on classic wooden pallets. Once brought to the floor they can easily be moved using a transpallet. **Biomattone®** has lower density compared to classic blocks, therefore it must be handled carefully, with both hands. If any block gets damaged during the transport or the implementation phase, it must not be discarded. Instead, it can be used safely by applying Malta Pronto on the affected areas. **Biomattone®** can also be cut into specific sizes or broken up and mixed together with the Malta Pronto.

PREPARATION:

Given the high hygroscopic capacity of the material, in order to avoid rising damp, the **first course** of **Biomattone®** must be isolated from the ground with a waterproof element (membrane, panels or similar) turned up to a minimum height of 20 cm above the ground. A first course of expanded cellular glass or water-repellent concrete blocks is ideal, with particular attention to thermal bridges.



Insulation of the first course with waterproof membrane



Insulation of the first course with cellular glass



INSTALLATION

MALTA PRONTA:

Use a mortar that has chemical and physical characteristics of expansion and elastic modulus similar to the ones of **Biomattone®**. For better results, it is highly recommended to use a Malta Pronta composed of **Legante Dolomitico Naturale** (Natural lime) and **Canapulo** (hemp shiv). Spread the mortar on the centre of the **Biomattone®** for at least 2/3 of its surface, creating a thickness of mortar of about 1.0 cm, necessary to level the next courses. Before laying the Malta Pronta, **Biomattone®** must be dampened by spraying clean water. Once the wall is finished, it is possible to fill the joints using “**Bio Beton® 300**”, ratio 2 to 1 of **Legante Dolomitico Naturale** and **Canapulo** previously mixed in a cement mixer and left to rest for a few hours. Pointing the joints allows to eliminate the thermal bridges generated by the Malta Pronta. It gives the surface, the necessary uniformity to apply the render. You can build up the wall to about 3m high without any particular precaution. When laying the blocks of a smaller thickness, it is advisable to reach about 1.5-2m high, wait for the Malta Pronta to “set” and then continue.



Installation spreading a layer of Malta Pronta



Installation spreading a layer of Malta Pronta

INSTALLATION

THE CUTTING:

Cutting **Biomattone®** is really easy. The blocks can be cut with a manual saw or using the following tools : alligator saw, reciprocating saw, chain saw or band saw. **Biomattone®** is 100% recyclable, therefore all the unused materials (waste) can easily be crumbled and mixed again by adding water and lime in the concrete mixer for the construction of substrates, for the insulation of cavities or to make Malta Pronta and renders.



Biomattone®
Example shaped (1)



Biomattone®
Example shaped



Biomattone® cutting with electric chain saw

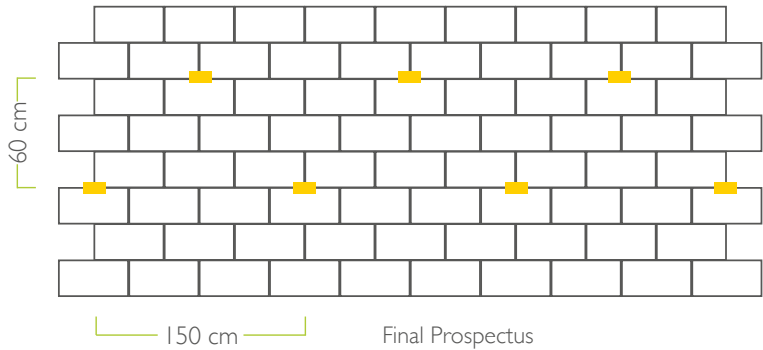


Biomattone® shaped block used to solve the thermal bridge from the structural frame

FIXATION TO THE LOAD-BEARING STRUCTURE:

The wall faces made of **Biomattone®** must be anchored to the load-bearing structure through anchor points of alternated courses, in association with the beams and the pillars. Anchoring is done by using an L-shaped galvanised metal brackets fixed to the supporting structure with rawlplugs, nails, or long screws for at least 6cm depth into **Biomattone®**.

In the case of a counterwall, a bracket with a rawlplug must be installed following an interval of 120cm horizontally, and keeping an interval of 3 courses vertically. Example: after two empty courses, the third is anchored, and after 2 other empty courses, the 6th is anchored and so on. Closing / sealing in the upper part of the wall made of **Biomattone®**, must be done using wooden wedges firmly attached to the structural beams or slabs, all sealed with the Malta Pronta (mixture of lime and hemp ratio 4 to 1 used at least 12 hours after its preparation). The walls or counterwalls of **Biomattone®** can stand heights up to about 4m depending on the thickness. Once this height is exceeded, the walls must relieve the excess load on a lintel or an inter-floor slab. If this is not possible (external counter-wall or formwork walls) a steel or wood lintel must be attached to the load-bearing structure to support the overlying portion of the wall.



CONSTRUCTION DETAILS

DOORS AND WINDOWS - BASIC FRAMES:

These must be sufficiently rigid to compensate the structure's settlement present at the corners of the openings. The installation process is the same as classical walls. The basic frames must be anchored to the block using turbo screws and anchors closed with the Malta Pronta. The shoulders can be made on site using a flexible or electric "alligator" saw or for a more precise work, the previously shaped **Biomattone®** can be installed.

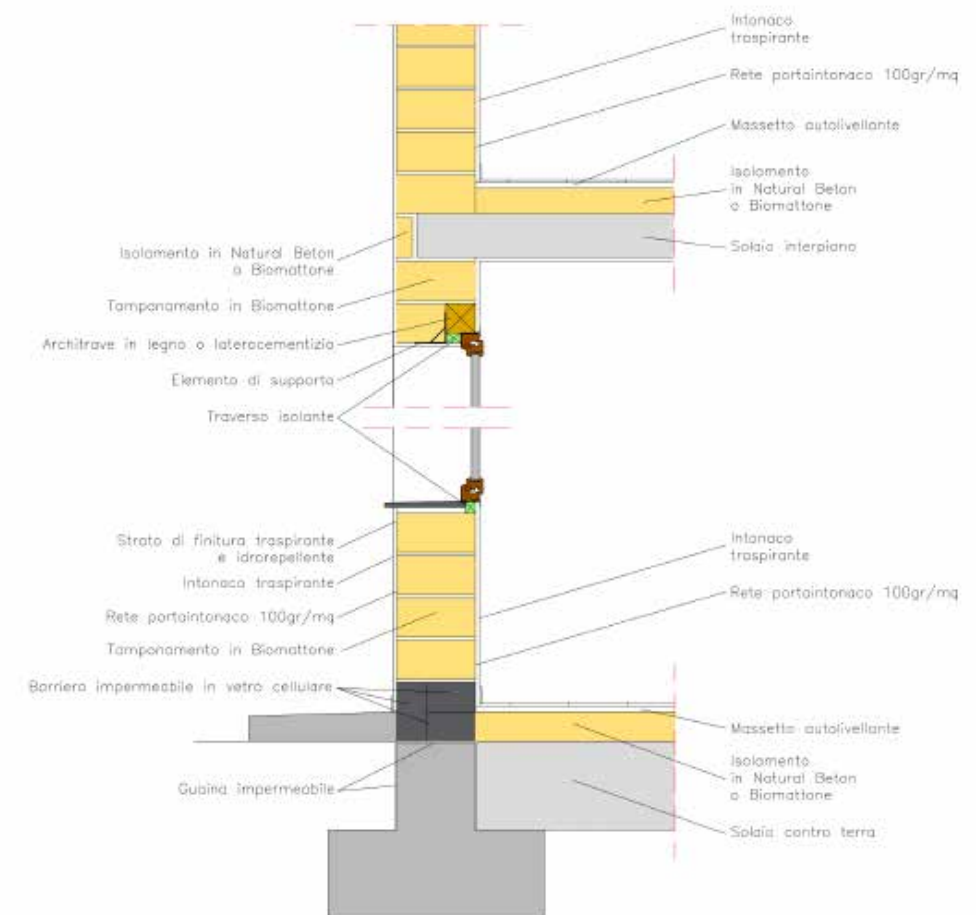


Installation of monobloc basic frame with EPS shoulders supplied by Senini



Shaping of the Biomattone® for housing the basic frame made on site

CONSTRUCTION DETAILS



GROOVES FOR MECHANICAL SYSTEMS:

Running electrical wiring or plumbing through the walls of **Biomattone®** is easily done by using a chainsaw and/or a hole saw cutter, directly on the finished wall. Electrical boxes and pipes can be secured with any quick-setting cement or preferably, using a mortar from natural lime. The mortar can be obtained by mixing **Legante Dolomitico Naturale** (Natural Dolomitic Binder) with **Canapulo** (hemp shiv) in a proportion of 4:1.



Grooves on Biomattone® for sanitary system



Grooves on Biomattone® for electrical system



LINTELS AND ARCHES:

The lintel must be placed on the wall of **Biomattone®** for at least a quarter of the width of the opening, on either side, and in any case for a minimum of 25cm for each side. You can use any type of lintels present on the market e.g.: clay, prestressed concrete and dried wood. The lintel must be slightly thinner compared to the width of the **Biomattone®** in order to avoid a thermal bridges.



Installation of a clay lintel on a wall made of Biomattone®

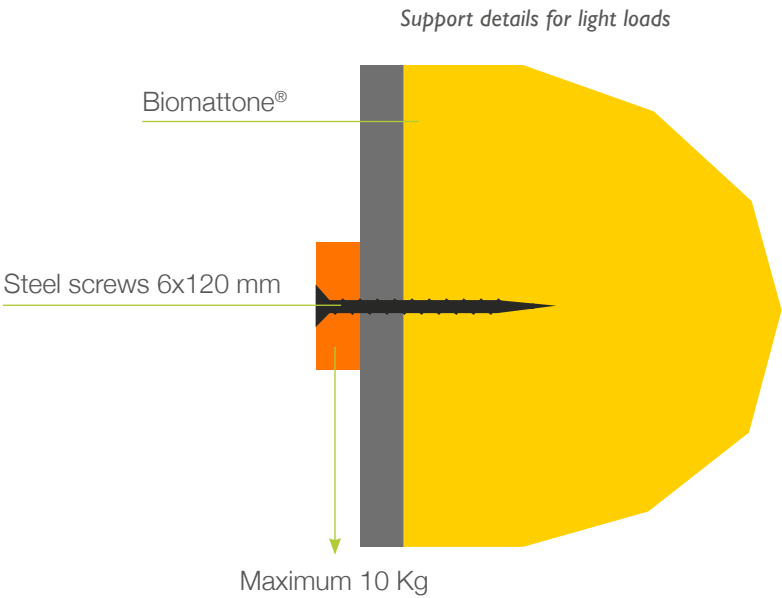


Installation of a dried wood lintel on a wall in Biomattone® including the correction for thermal bridges

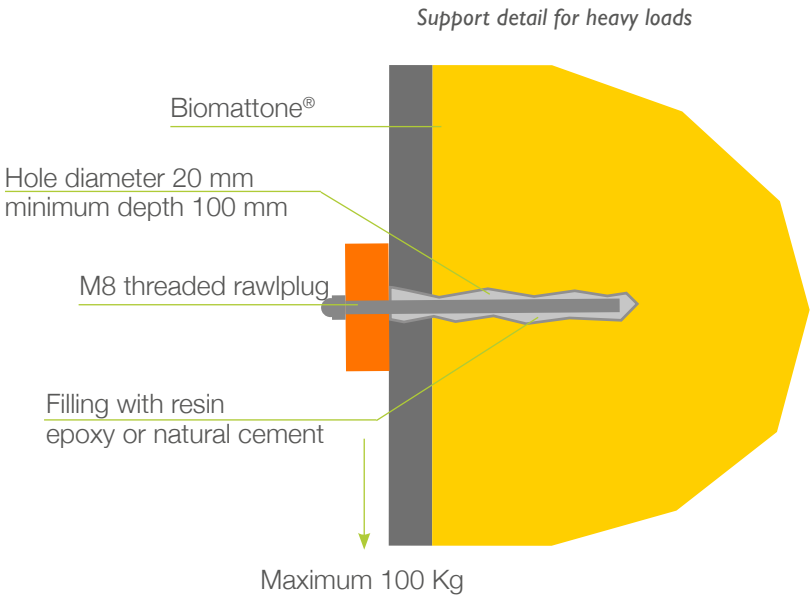
CONSTRUCTION DETAILS

FIXATION OF SHELVES, PAINTINGS, ETC..:

It is possible to hang loads on **Biomattone®** by following special precautions as illustrated in the images below.



In case of heavy loads, insert mechanical anchors or threaded bars downed in epoxy resin or rapid cement, for minimum 10cm depth.



CONSTRUCTION DETAILS

CORRECTION OF THERMAL BRIDGES FOR STRUCTURAL FRAMES:

The best way to correct the thermal bridges generated by the load-bearing structure is to shape **Biomattone®** and cover the frame with a suitable thickness. The **Biomattone®** of 36 and 40cm allows to prevent thermal bridges since pillars and beams can easily be covered with the appropriate thickness of **Biomattone®**. In this way, in addition to correcting the thermal bridge, the surface uniformity is guaranteed making it ready for the finish. If this is not possible, other types of insulating panels can be used by paying particular attention when laying the plasters.



Steel frame: Thermal bridge correction with Biomattone® shaped at the corner column

PLASTERING AND SKIM COATING

Given the breathability characteristics of **Biomattone®**, in order to not invalidate this ability, it is necessary to use breathable plasters made from natural lime. After a delay of about 20 days from the laying of **Biomattone®**, if the weather conditions allow it, it is possible to start applying the plaster:

PREPARATION:

Dampen the entire surface with water to excess as for any porous and absorbent surface. Be careful especially in the hot months of summer, when the operation will have to be repeated several times if you allow time to pass before laying the plaster.

PREPARATION OF CRITICAL POINTS:

The critical points are specific areas where the appearance of cracks related to structural settlements or expansion is predictable due to the thermal discontinuity of the wall components. The following parts must be treated with particular attention:

- Windows frames, thresholds and sills
- Boxes for roller shutters
- Wherever there's a change of material
- Presence of panels of any type (celenit, xps, reinforced concrete, wood, gypsum fibre or concrete slabs, etc.)
- Pre-existing cracks or damaged areas

We recommend laying a double coat of **Stabilitura Naturale Traspirante Plus** (Natural Breathable Skim Coat) reinforced with a mesh, according to the following procedure:

1. Spread the **first coat** with a notched trowel, a layer of **SNT+** of at least 2-3 mm and apply the mesh. We recommend the mesh of 145-165 gr/m2 and 5x5mm. Press with a smooth spatula until the mesh is hidden in **SNT+**. If necessary, apply a new sheet of mesh overlapping at least 30/40 cm.
2. After 12 hours, apply a **second coat** with a notched trowel, by spreading the **Stabilitura Naturale Traspirante Plus** horizontally and taking care to leave the grooves visible to facilitate the adhesion of the next layer of plaster. Total 3-4mm for both coats.

NOTE On the inner part of the openings, the mesh must be laid vertically and horizontally along the sides, while at 45 ° in the corners in the form of a dressing having an adequate size for both length and width.



Application of an overcoat mesh with a first coat of Stabilitura Naturale Traspirante Plus

PLASTERING AND SKIM COATING

To maintain the hygroscopic capacity of hemp and lime, it is essential to use a breathable finish.

1. First step, **rough coat**: Dampen the substrate with clean water and apply **Intonaco di Calce Naturale** (Natural Lime Plaster) evenly on the entire surface for a thickness of about 5 mm. The application can be carried out manually or with a spray machine.
2. Second step, **base coat**: (after at least 12 hours): To guide the application of the plaster, dampen the rough coat and create strips of about 15 mm thick. Carry out the filling by applying **Intonaco di Calce Naturale** manually or with a spray machine.
3. Third step, **external skim coat**: after at least 5-7 days of air T° between 15 and 30°C): Dampen the base coat and apply the first coat of **Stabilitura Naturale Traspirante** (Natural Breathable Skim Coat) with a thickness of 1-2 mm and immediately affix a reinforcing mesh to the wall by pressing the mesh with a trowel, until it gets hidden in the render. Overlap the mesh for at least 10 cm. The size of the mesh needs to be 5x5 mm and it should weigh from 145 to 165 g/sqm. After 12-24 hours, dampen the surface with clean water and apply the second coat of **Stabilitura Naturale Traspirante**, still with a stainless-steel trowel, and adjust with a sponged trowel until the surface is perfectly flat. The total thickness of skim coat should be around 4 mm.
4. Third step, **internal skim coat**: (after at least 5-7 days of air T° between 15 and 30°C): Dampen the base coat and apply the first coat of **Malta Fine di Grassello e Sabbia** (Fine Mortar of Lime Putty and Sand) with a thickness of 1-2 mm. After 12-24 hours, dampen the surface with clean water and apply the second coat of **Malta Fine di Grassello e Sabbia**, still with a stainless-steel trowel, and adjust with a sponged trowel until the surface is perfectly flat. The total thickness of skim coat should be around 3 mm.



External skim coat



Internal base coat

AIRTIGHTNESS

If you want to create a building with a very low energy consumption, you cannot do without checking its airtightness. During the design phase, particular attention must be paid to the junctions between buildings materials, and mechanical elements like electrical outlets, switches etc. Those are parts of the building that can have cracks that give rise to uncontrolled air exchanges between inside and outside.

WALL-COLUMN JOINTS:

As for the junction against the ceiling, airtightness must also be guaranteed along all vertical uprights of the structure's elements. It will be necessary to fix a vapour barrier along the pillar and lock it, for at least 1.5 cm on each side within the plaster of the perimeter wall of **Biomattone®**.

SUBFLOOR JOINTS:

By using **Biomattone®** to insulate subfloors, the airtightness between the perimeter wall and the substrate is guaranteed without the necessity of a vapour barrier.

ELECTRICAL OUTLETS:

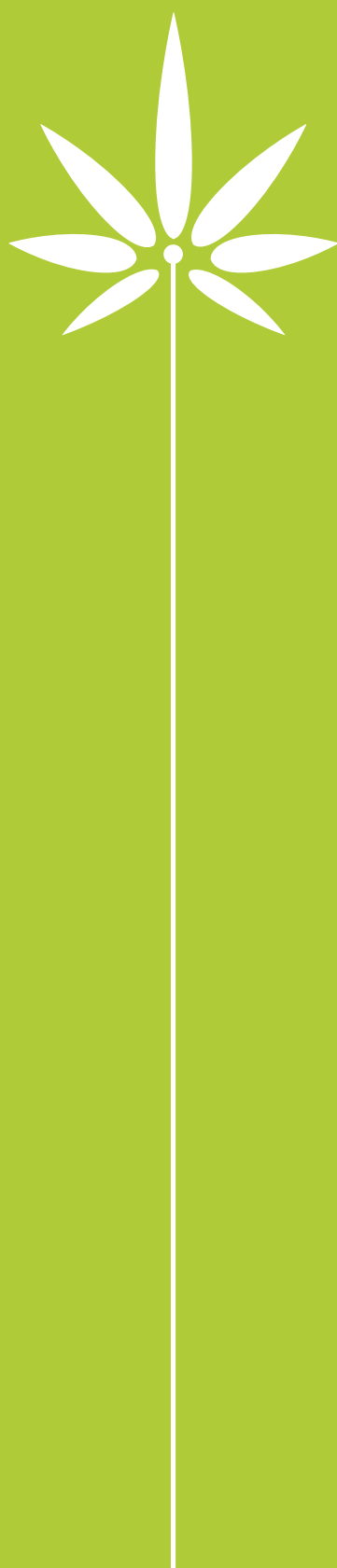
To obtain a high level of airtightness during the installation of the electrical or telephone system, you must follow simple rules: use sealed boxes or seal unused holes, lock the sheaths of the pipes, finish with plaster.

CEILING JOINT:

The airtightness of the ceiling is obtained by spreading a vapour barrier along the entire length of the beams of the load bearing structure. The vapour barrier is then drowned in the plaster of the wall of **Biomattone®** for at least 1.5 cm, above and below the ceiling.

WINDOWS:

The airtightness along the junction between the wall of **Biomattone®** and the window frame is obtained with a vapour barrier that from the parapet is closed in the internal plaster of the wall for at least 1.5 cm. The airtightness of a building envelope can be certified with a 'Blower Door Test', which measures the rate of air exchange due to infiltrations. By performing this test during the implementation phase, corrective measures can be applied against heat loss thus preventing damage to construction elements and related costs of renovation.



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