Core
CONSERVATION

Traditional thermal insulation of old walls

Thermal Insulating Old Solid Walls

Technical Guide

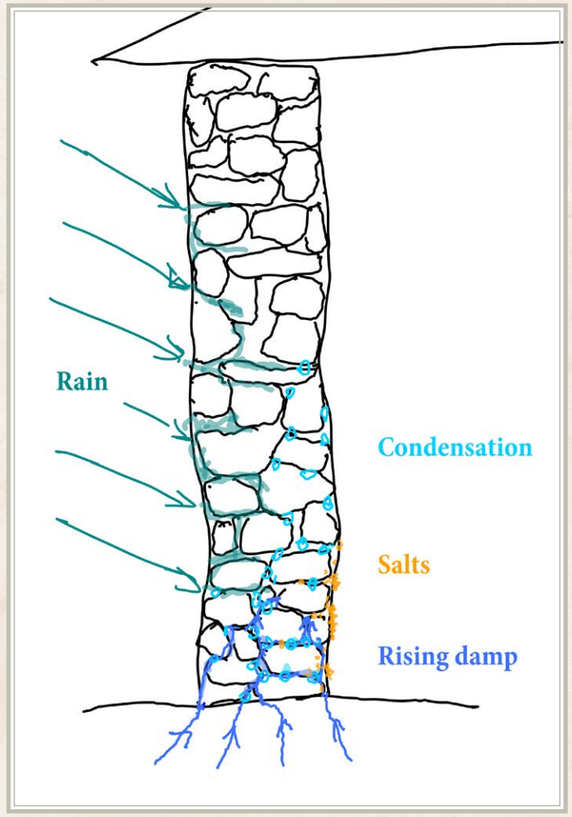
The Problem

Energy efficiency of old buildings is a hot topic nowadays. Unlike new buildings which are designed and built with adequate insulation in mind, the retrofit insulation of old buildings – especially the ones with solid walls – poses significant challenges, as the materials used in this regard must satisfy multiple (often conflicting) requirements:

- **Resist moisture**: due to their construction, old solid walls are constantly subject to multiple sources of moisture, the most important being *wind driven rain* and *condensation*. Wind driven rain can easily saturate external walls. Temperature differences can be an ongoing source of condensation on external walls. Moreover, the base of old walls is often subject to *rising damp* resulting in additional moisture and *salt damage*.
- **Breathable**: in order to prevent the build-up of moisture behind the insulation (which can seriously damage the building fabric long-term), all this humidity must be able to evaporate, so the insulation **MUST be breathable**.
- **Traditional look and feel**: wherever possible, the use of traditional, building-friendly materials is recommended.

The vast majority of insulating solutions on the marketplace have been developed for newer buildings. They offer good thermal insulation, but modern materials – foam, plastic, metal foil, cement etc. – are **non breathable** and thus **trap moisture**.

Many traditional breathable materials that can last for decades in a damp-free environment, deteriorate quickly in the presence of elevated humidity and corrosive salts.



Most common moisture sources affecting solid walls

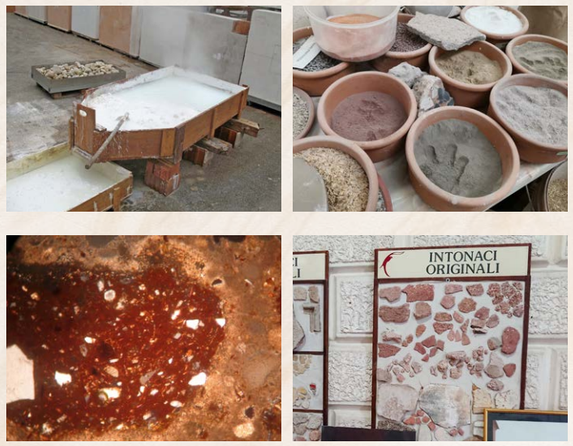
Solid brick or *rubble-filled solid stone walls* subject to moisture, push traditional materials and lime plasters to their limit, resulting in a significantly shorter lifespan and decreased performance.

Due to increasing energy costs, government pressure as well as the need for greater comfort, breathability is often sacrificed, which leads to severe dampness problems years or decades later.

The Right Solution

The most critical component of an insulation system used on old walls prone to moisture is the existence of a **protective moisture barrier** that *blocks liquid water* (keeping the insulation dry and long-lasting) while *letting water vapours pass through* (breathable).

This can be achieved with a traditional lime plaster of which origins stretch back to **ancient Rome**. Being outstanding architects and builders, the Romans have discovered that by adding **volcanic soils and other minerals** to lime, they can significantly alter its properties, especially its *mechanical strength* and *water resistance*, while *retaining its breathability*.



Mixing lime putty with volcanic minerals (pozzolans) can make lime renders waterproof while retaining their breathability

The materials most commonly added to lime were ***pozzolans*** *(volcanic soils or rock fragments)* and ***cocciopesto*** *(milled bricks or terracotta fragments)*. These reacted chemically with the free lime, forming *water resistant compounds*. Such mortars were able to *harden quicker* not only *in the presence of water* but even *underwater* in the total absence of air, and they are known as **hydraulic mortars**.

It is important to understand that **the degree of porosity and breathability of lime plasters is primarily determined by the properties of lime** and not by its hydraulic ingredients, an important factor being the firing temperature of lime. By firing limestone at low temperatures (at around 850-900 °C), the *breathability of lime is retained*, while the natural volcanic hydraulic ingredients make the mortar *fully waterproof*. These are different from today's NHL mortars, whose much higher firing temperatures (~1200 °C) impair their breathability; the "harder" an NHL the less breathable.

These lime mortars have been extensively used by the Romans in very demanding environments including ***sewers, ports, spas and aqueducts***. They have also been widely used in *Venice*, well suited to the humid and aggressive environment of the Venetian lagoon.

Internal, External or Combined Insulation

Thermal insulation can be applied either internally, externally or combined.

Which one is the best option for you it depends on a number of factors, such as:

- Building type and wall construction
- Location (e.g. coastal area subject to driving rain)
- Size of internal space
- Planning considerations (e.g. conservation area, listed building) and others.

The main components of this traditional long-lasting, breathable lime insulation system are:

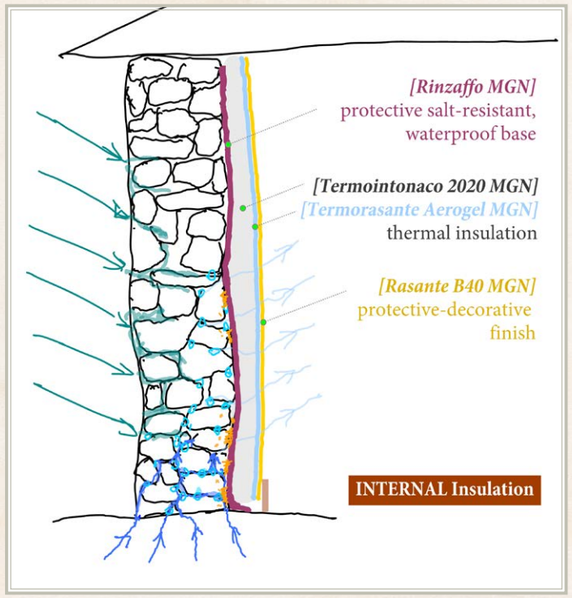
1. **Protective Salt-Resistant Base**: *dampness* and *crystallizing salts* are the main factors responsible for the premature breakdown and crumbling of any lime plaster, especially in areas close to the ground.

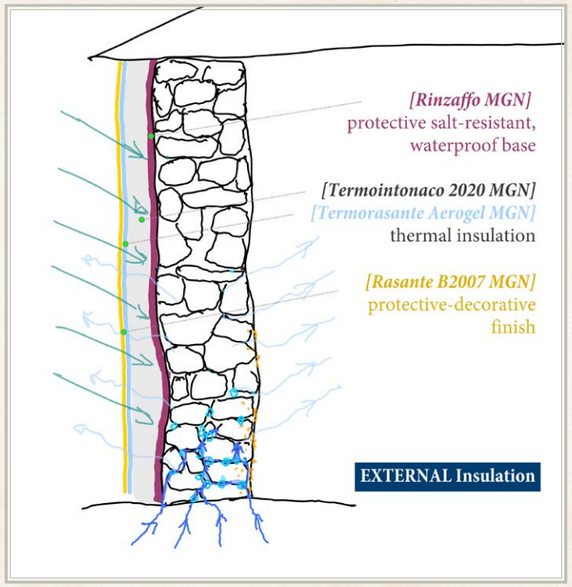
   Applying this special Roman salt-resistant, waterproof but breathable lime coat protects the insulation, *increasing its life significantly* (about 10X) by **keeping liquid water and salts away**.

2. **Thermal Insulation**: the insulation can be applied both internally and/or externally. For best insulation, depending on your application, various thermal plasters *can be combined*.

   The thermal insulation of our lime plasters have *industry-leading thermal values*, insulating about 15-20X better than "regular" lime plasters or about 50-70X better than cement plasters.

3. **Protective-Decorative Finish**: because thermal insulation plasters are relatively soft plasters, they are protected by a lime protective-decorative finish. This can have a rustic, slightly gritty or a completely smooth appearance.





Examples

Here are some application examples for both internal and external thermal insulation.

Plastering Schedule

Here are the plasters that go into our lime thermal insulation system. They can be applied to any old or new building, where *excellent thermal performance*, *long life expectancy* and *outstanding brethability* are required.

1. Protective Base Coat

RINZAFFO MGN [10 mm]

This is a microporous **breathable lime waterproof and salt-resistant base coat**. Its main role is to protect the main thermal plaster from liquid water ingress and salts, making the plastering last much longer.

Its internal pore structural blocks (large) liquid water molecules and salts, while letting (much smaller) water vapour molecules passing through, regulating the evaporation of the wall.

Being **waterproof and breathable**, it can be used as:

- **A base coat** for replastering after *rising or penetrating damp*
- **A render** against *driving rain*
- **A lime-based "tanking slurry"** for *waterproofing basements*
- **A plaster** against chimney salts around *old fireplaces and chimney stacks*
- **A waterproof floor base** against *pressure water* or *flooding*

2. Thermal Insulation Plasters

We have several lime insulating plasters, which, depending on your insulation needs, can be applied individually or combined.

All thermal plasters have high porosity, outstanding breathability and vapor permeability, *preventing the appearance of condensation and mold*, while also offering *excellent acoustic soundproofing*.

A. TERMOINTONACO 2020 MGN [up to 120 mm]

Our main thermal plaster, an extremely lightweight (278 kg/m³) traditional lime thermal plaster with excellent insulating properties (λ = 0.04). It can be built up to a considerable thickness (up to 120 mm) in subsequent 20 mm coats.

B. TERMORASANTE AEROGEL MGN [10 mm or more]

This is a lime plaster mixed with *Aerogel*, one of the lightest solid materials known to man with extremely low thermal conductivity (λ = 0.01).

Due to its high aerogel content, offers *outstanding thermal insulation* in a thin form factor – providing an elegant breathable solution against *condensation problems* in any building.

The application of a thin (5-10 mm) plaster coat can raise the surface temperature of walls by 3 to 5 °C. Thanks to its excellent heat reflectance, it reflects the heat back into the room, creating high thermal comfort indoors.

C. CANAPATERM MGN [up to 120 mm]

It is a **hemp-lime** natural insulating plaster, used for thermal and acoustic insulation. Due to its *hemp and natural lime* content offers a number of benefits, such as:

- *Regulates internal humidity*, resulting in warmer buildings during winter and cooler buildings during summer
- *Eliminates the risk of respiratory diseases* caused by mold and moisture
- *Better air quality,* reduces air pollution, absorbs CO_2, better living comfort

3. Protective Finish

RASANTE B40 MGN [3-4 mm]

This is a white lime finishing plaster, used as a protective coat over thermal plasters.

Depending on application, the surface of the plaster can be made completely *smooth* or left slightly *textured* as a traditional rustic lime plaster.

Application

1. Preparation of the Wall Fabric

Hack off the old plaster, remove all loose parts and foreign materials (wood, tar, metals etc.). Clean or wash the surface thoroughly to remove all loose debris and residues.

Before the application of each new coat, wet the surface abundantly.

2. Applying the Salt Resistant Base Coat

Pour the contents of the Rinzaffo MGN package into the mixer adding **clean tap water only**. **Do not add any additives or other materials** (e.g. cement, gypsum etc.) **to the mix**. Mix it for about 3-5 minutes until a homogeneous, creamy paste is obtained. Do not overwork it.

On freestanding walls apply a 10 mm coat, covering the whole surface, **leaving no gaps**. For areas underground or subject to sideways water pressure, apply two 10 mm coats with a fiberglass mesh in-between. Wait 1-2 days between subsequent coats.

Darker spots of the first coat denote areas of insufficient thickness of the render. Patch them up with additional Rinzaffo before applying the main coat.

Dark patches: insufficient thickness

Uniform color indicates good coverage

3. Applying the Main Thermal Coat

After the Rinzaffo MGN scratch coat has dried, apply a first thermal coat of your choice.

Mix the contents of the package with clean water in a quantity necessary to obtain a uniform plaster. If using a cement mixer mix it for no longer than 5 minutes.

Wet the surface between the application of each layer. Apply the plaster in max. 20 mm thick layers. Level each layer without compressing it. Apply a new layer only after the previous layer has hardened.

3. Applying the Protective Finish

Before applying the protective finish, it is advisable to allow the thermal plaster to mature for 15 - 20 days. Apply the Rasante B40 MGN finishing plaster for internal applications or the Rasante B2007 MGN plaster for external applications, which offers improved weather protection to external thermal insulations.

WE OPERATE NATIONWIDE – Please contact us with any questions

CORE CONSERVATION LTD

office@coreconservation.co.uk
www.coreconservation.co.uk

NORTHERN OFFICE
Unit 50, 12 South Bridge
Edinburgh, EH1 1DD
Tel: 0131 654 9074, 07507 468303

SOUTHERN OFFICE
64 Woodbury Ave
East Grinstead, RH19 3UX
Tel: 01342 300 598, 07455 077002

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