



Manufacturer and supplier of traditional and environmentally-friendly building materials.

## Types of Lime

There are many types of lime on the market. It is crucially important to understand their differences and the way in which they perform, only then is it possible to make an informed choice about which lime to use for different environments.

## Slaked/High Calcium/Putty/Air/'Fat' or Non Hydraulic Lime

The lime is produced by slaking fresh quicklime in an **excess of water**. It is also known as non-hydraulic lime because it requires exposure to air in order to carbonate and does not set under water. **This lime is regarded as the most appropriate lime for old buildings where maximum permeability and flexibility is required.**

Premixed 'wet' products are made from this lime putty with the addition of an aggregate and/or fibre.



## Hydrated or 'Bag' Lime

This is the lime generally available in builders merchants. It is a non-hydraulic lime produced by slaking Quicklime with a shortfall of water which results in a powder. It is generally considered to be an inferior product to the fat lime putty described above for a number of reasons but primarily because it starts to degrade from the moment it is made and can actually fully carbonate in the bag before use. Widespread use of 'bag' lime has given 'lime' a poor name because of instances where it simply has none of its original properties left by the time the end-user work with it, hence it fails, dusts etc. If 'bag' lime is the only option, then it should be purchased as fresh as possible and left to soak for two days in clean water. Although the resulting product is chemically the same as 'fat' lime putty, it is physically different, in particular it is less 'sticky'.

## Natural Hydraulic Lime

In more recent years, hydraulic 'hydrated' limes have been successfully produced from limestone containing clay and other impurities which gives it a faster initial set in more extreme conditions (including underwater). There are many types of hydraulic lime and they are categorised according to the following (NHL - Naturally Hydraulic Lime): where the number refers to the compressive strength of the mortar

after 28 days (please note the selection of aggregate and mix ratio will also effect the final strength).

- > **NHL2** - contains less than 12% clay which means it is slower to set;
- > **NHL3.5** - contains 12%-18% clay which gives a slightly faster set;
- > **NHL5** - has up to 25% clay content which means that a much faster set is achieved.

These limes have become increasingly popular over the last decade because of their comparative 'ease of use' and 'strength', compared to fat limes.

Dry, premixed hydraulic lime mortar/plaster are now available - see following pages.



## Pozzolans

Pozzolans are 'heated' materials such as brick dust, Pulverised Fuel Ash (PFA), Calcined Clay, that contain silica, alumina and iron which become reactive to alkalis including lime. They are frequently used to help to give a fat lime mortar a 'faster' set (essentially creating an **'artificial hydraulic lime'**) and are therefore helpful in many situations to broaden the applications for fat limes. It is believed that many historic mortars were 'fat' or 'non-hydraulic' as they often contain these 'heated materials' which change the performance of the mortar. Today hydraulic limes are more commonly used, sometimes wrongly, for increased set and strength. Please see below for some guidance on specifying and choosing the right lime.

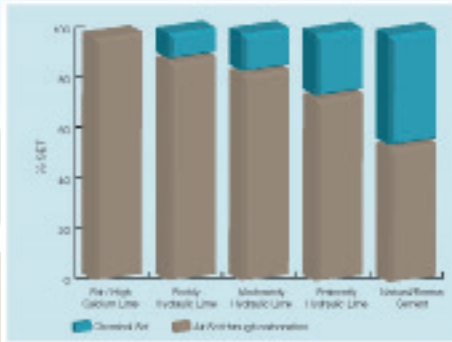
*For further information about the whole subject and illustrated diagrams of plastering and pointing techniques, The Lime Handbook is available at [www.lime.org.uk](http://www.lime.org.uk)*



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## Properties

Understanding the properties of the various limes will help ensure a successful result through appropriate specification, see below.



This chart shows the chemical vs the air setting properties of different types of lime. Care and protection is required for those with greater air setting properties.

| Type of Lime/ Binder                       | Pure/Air Fat Lime Putty             | Hydraulic Lime NHL2                    | Hydraulic Lime NHL3.5               | Hydraulic Lime NHL5                 | Natural/Roman Cement                    |
|--|-------------------------------------|--|-------------------------------------|-------------------------------------|---|
| Impurities which affect setting properties | Negligible                          | Under 12% natural active clay minerals | 12-18% natural active clay minerals | 18-25% natural active clay minerals | Natural mix of limestone plus clay >50% |
| Vapour Permeability (ng/Pa.s.m)            | 0.5 - 2.0                           | 2.0 - 5.0                              | 3.5 - 10                            | 5.0 - 15.0                          | 12.0 - 20.0                             |
| Strength (N/mm <sup>2</sup> )              | Soft, slower set, good permeability |  |                                     |                                     | Strong, rapid set, poor permeability    |

The below diagram shows the 'trade offs' that need to be considered when choosing a lime - the stronger the lime, the faster it sets but the compromise is 'vapour permeability' and 'flexibility'

## Choosing a Lime

It is important for the well being of the building that the most appropriate lime product is chosen. Every situation needs to be carefully assessed e.g. in terms of

- > **Softness of the stone, brick etc.** - this should be a major factor in selection. The mortar should always be softer than the stone/brick.
- > **The environmental conditions** - where the environment is very wet e.g. sea-defence walls, canals, copings, pavings; a hydraulic lime is more appropriate because of its ability to set underwater.

## Lime Mortar Selection

| Application                     | Type of Lime   | Notes   |
|---------------------------------|--|---|
| Pointing                        | <b>Premixed Lime Mortar</b>  | <ul style="list-style-type: none"> <li>The exact ratio will depend on the sand/aggregate used.</li> </ul>   |
| Building Stonework<br>Brickwork | <b>Natural Hydraulic Lime NHL3.5</b> (External - Exposed locations)<br><b>NHL2</b> (External/Internal)<br><b>St. Astier EcoM Pointing</b> (Dry Premix)<br><b>Secil Cal RJ</b> (Dry Premix) | <ul style="list-style-type: none"> <li>The colour, texture, workability and success of the mortar is predominantly influenced by the selection of sand/aggregate.</li> <li>The softer the stone/brick, the softer the mortar should be.</li> <li>To match an existing mortar, send a sample to us.</li> </ul> |
| Flag Stone Bedding (>20mm)      | <b>Hydraulic Lime NHL5/NHL3.5</b>  | <ul style="list-style-type: none"> <li>3:1 mix ratio. Thickness of bedding mortar will vary depending on flagstone thickness.</li> </ul>  |
| Stone Tiles (<20mm)             | <b>Adhere Cal</b>  | <ul style="list-style-type: none"> <li>For thinner tiles internally, use Adhere Cal for tiles less than 20mm thick.</li> </ul>  |
| Paving Copings<br>Chimneys      | <b>Hydraulic Lime NHL5</b>   | <ul style="list-style-type: none"> <li>For exposed areas, or any high weathering applications.</li> <li>For these extreme areas ensure work is done as early as possible in the year as soon as danger of frosts are over.</li> <li>Drainage of paving areas is paramount.</li> </ul>                         |

\*It is important to choose a sharp, well graded, well washed sand.  
NHL = Natural Hydraulic Lime

- > **The existing materials** - repairing like with like - this will usually provide the most satisfactory solution both aesthetically and technically, however it should not be done without considering the performance of the original materials, as well as the future demands.
- > **The time of year** - the ideal time to do fat lime work, particularly external work, is during the spring and early summer, lime work should never be completed when the temperature is likely to fall below 5°C before carbonation has taken place (which can be months). Therefore, if work can not be rescheduled to another time of the year consideration should be given to adding a pozzolan to a fat lime (e.g. PFA, GGBFS) to speed up the set or to using a hydraulic lime. Appropriate protection is vital.
- > **The available time** - occasionally work is programmed without enough time to support the use of the materials specified, rapid builds necessitate rapid sets therefore adding a pozzolan to a fat lime or using a hydraulic lime should be considered (if work cant be reprogrammed!).

## Traditional Lime Plaster Selection

| Building Material <sup>a</sup>                                      | Site Type | Suggest Base Coat/ Levelling Coat           | Suggested Build Up | Suggested Top Coat<br><small>- please note the top coat should not be stronger than the base coat</small> | Suggested Build Up |
|---|-----------|---|--------------------|---|--------------------|
| Cob / Rammed Earth / Strawbale <sup>b</sup>                         | Internal  | Fat Lime Base Coat (Cumbrian (with fibres)) | 2 x 9mm            | Fat Lime Top Coat   | 1 x 3mm            |
|   | External  | NHL 2/3.5 & Aggregate                       | 2 x 9mm            | NHL 2/3.5 & Aggregate   | 1 x 6mm            |
| Lath / Reed Mat / Reed Board  | Internal  | Fat Lime Base Coat (Cumbrian (with fibres)) | 2 x 9mm            | Fat Lime Top Coat   | 1 x 3mm            |
|   | External  | NHL 2/3.5 & Aggregate                       | 2 x 9mm            | NHL 2/3.5 & Aggregate   | 1 x 6mm            |
| Celenit Wood Wool Boards / Cork Boards / Schneider Woodfibre boards | Internal  | Fat Lime Hemp Plaster                       | 1 x 9mm            | Fat Lime Top Coat   | 1 x 3mm            |
|   | External  | Secil Isovit (Meshed)                       | 1 x 10mm           | Secil Cal Ac  | 1 x 3mm            |
| Brick & Masonry <sup>c</sup>  | Internal  | Fat Lime Base Coat (with fibres)            | 2 x 9mm            | Fat Lime Top Coat   | 1 x 3mm            |
|   | External  | NHL 2/3.5 & Aggregate                       | 2 x 9mm            | NHL 2/3.5 & Aggregate   | 1 x 6mm            |
| Concrete Blocks / Insulation Blocks                                 | Internal  | Fat Lime Base Coat (with fibres)            | 2 x 9mm            | NHL 2/3.5 & Aggregate   | 1 x 3mm            |
|   | External  | NHL 2/3.5 & Aggregate                       | 2 x 9mm            | NHL 2/3.5 & Aggregate   | 1 x 6mm            |

<sup>a</sup>Dub out uneven surfaces prior to applying first coat. <sup>b</sup>May require more coats due to undulations of the bales. Strawbale mix is available. <sup>c</sup>Insulation blocks have very high suction, be careful to maintain moisture content in render. Please note Manufacturers application guides must be followed. Exposed elevations may need more coats.

Occasionally, the choice still seems to be based on the availability of skills, unfortunately, lack of experience means that often the stronger hydraulic limes or even cement are introduced into buildings where they have no place and will, in the long term, almost certainly contribute to damp problems and damage the very fabric of the building.

Other information sheets consider the various lime-based products in more detail and set out some 'golden rules' for successful results. Before beginning to use any lime product, it should be understood that lime is caustic and eyes and skin should be protected at all times.

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