

A Basic Guide to the Specifier

The information given by lime manufacturers to allow the specifier to have a clear definition of the chemical structure, mechanical properties and performance of their products is essential. The lack of it has led not only to confusion but also to misuse and, regrettably, to problems which have been wrongly attributed to the lime and the mortar designed with it.

What you should know and how to check that you have the correct product (and relevant St. Astier information)

There are a number of products on the Market, which can interest the specifier, however it is important to know what to choose. St. Astier Natural Hydraulic Limes are chosen for a number of reasons, the most important of which are:

Absence of or only traces of soluble salts such as SO₃, K₂O (Potassium Oxide) and Na₂O (sodium oxide)

Absence of Tri-calcium aluminate (C3A). No gypsum additions

This is to avoid sulfate attack that normally happens in mortars prepared with cement or where white cement has been introduced into so called natural hydraulic lime at manufacturing point to ensure an hydraulic setting. When cement is present, you will find a high percentage of C3A which will react with the sulphates producing an overall expansion and the eventual disintegration of the mortar joints. Another addition made at manufacturing source could be Gypsum. Products containing Gypsum addition should be avoided, as Gypsum is high on sulfates. Presence of K₂O and Na₂O (Alkali), even in apparently small quantity (1.5% ca. in ordinary cement) could react with the silica in the aggregate causing an alkali-silica attack with similar consequences as sulfate attack.

How to check: ask your supplier to provide a chemical /mineralogical analysis certificate or conduct a laboratory check on a random sample.

St. Astier information: no cement or gypsum addition, only insignificant traces of potentially damaging components are found in St. Astier NHLs

Component EU norm EN 459.1 St. Astier NHL5/3.5/2

SO₃ Max. SO₃ limit-% 3-7 SO₃ content/average-% 0.31 \blacklozenge 0.45

C3A % 0.40 \blacklozenge 0.70

K₂O % 0.12 \blacklozenge 0.21

Na₂O % 0.04 \blacklozenge 0.07

CaSO₄ % 0.50 \blacklozenge 0.70

High % of available lime (after slaking)

Available lime (free lime) is important for workability, self-healing properties and elasticity. It will also contribute to final strength. Free lime will allow some tolerance for initial structural movements. NHL mortars will therefore offer adequate strength with enough plasticity to accept slight load shifts.

St. Astier information

Available lime to comply with NHL (natural hydr. lime) definition in EU and French norms

NHL EU 459.1 norm French NFP 15.311 St. Astier NHL

% % %(+5%)

NHL 5 - 3%

NHL 3,5 - 9%

NHL 2 - 15%

What you should look for in a pure NHL product: a high % of free lime.

How to check: ask your supplier for the relevant information or conduct tests.

Good vapor exchange qualities

Essential to ensure breathing and therefore absence of condensation and dampness.

Some indication of vapor exchange (permeability) in mortars are:

Concrete 0.15 Cementitious mixes (1:1:6) 0.23 \blacklozenge (1:2:9) 0.25

Hydrated lime mortars 0.46/0.51 Putty lime mortars (22%) 0.57

St. Astier NHL Mortars: 0.55 \blacklozenge 0.72 (made with well graded #6 - #200 (3mm-0.075) sands to ensure good void structure)

Figures are expressed in grams of air x m² x hour x mmHg.

Low expansion (soundness test) and quick lime residual (CaO)

The EU norm (soundness test in accordance to EN 459-2/5.3.2.2) specifies a value of < 5/64" (2 mm). All St. Astier production is checked continuously for soundness and materials with unacceptable values are rejected (not recycled).

The presence of quick lime would make an unstable mortar.

Make sure that your supplier gives you these values to avoid problems

St. Astier information

Expansion values of NHL products

All St. Astier NHL products have an expansion value of < 3/64" (1mm)

Quick lime presence: < 1%

Quick setting (resistance to frost, rain and wind)

Pure and natural hydraulic lime mortars do not need to be protected for a long time. Manufacturers should however give indications on the minimum time required. The quick resistance to bad weather conditions is an additional assurance also in changing seasons when a sudden change of weather could damage work, which was left unprotected. Fresh mortars, however, should not be allowed to become saturated by rainwater, as they might be susceptible to frost damage, especially in the finishing coat.

St. Astier information

NHL products ♦ Minimum frost and bad weather protection time on dry mortars

NHL 5 1 day NHL 3.5 10 days NHL 2 14 days

Query on pozzolanic or other additions

Products that requires these additions are not offering a constant and reliable performance or need a "push" according to the season. Most of the times no data are available on the effect of the additions over a period of time. Furthermore additions will add to cost and to possible mistakes on site dosages. The various degree of hydraulicity offered by the St. Astier range make additions obsolete.

Low density

It comes into consideration when material costs are examined. In volumetric mixes the higher the density of the binder the higher will be the amount you would have to use in weight.

CHECK: bulk density of the proposed binder.

St. Astier information

Binder consumption for 1 ft³(m³) of mortar: volume/weight comparison with sand density of 93.6 lbs/ft³ (1500 kg/m³)

VOLUME OF MIXES / lbs x ft³ (kg x m³) (+/-10%)

Binder Average Density (+/-10%) 1:2 1:2.5 lbs/ft³ (kg/m³)

NHL 5 41.2 (660) 20.8 (333) 16.6 (266)

NHL 3.5 38.1 (610) 19 (305) 15.2 (244)

NHL 2 34.3 (550) 17.5 (280) 14 (224)

Lime Putty 84.3 (1350) 42.1(675) 33.7 (540)

W. Cement 90.5 (1450) 45.3 (725) 36.2 (580)

Whiteness index

The whiter the product the better results will be obtained in reproducing the color of the aggregate used. The St. Astier range offers some of the whitest NHL product on the Market.

St Astier information - Whiteness index "Y"

Barium sulfate (pure white) Y = 100

NHL 5 = Y 67 NHL 3.5 = Y 72 NHL 2 = Y 76

Resistance to sea salt and road spreading salt effects

Check that the lime you intend to specify will not be affected by these agents when designing a mortar to be applied in areas subject to these influences. Lime containing cement or gypsum would not be suitable. St. Astier NHL products have been successfully used in these conditions without deterioration.

REMINDER

It is essential that the right aggregate is used in making hydraulic lime mortars. Monogranular or very fine sands could have disastrous effects and should be avoided or used as a minor proportion of the mix. Sands suitable for NHL mortars must be well graded from #6 (3mm) to #200 (0.075).

Finer sands, still well graded, can be used. In the case that the fine portion contains silt or clay the binder amount will be reduced. Remember that clays and

silt will retain water increasing the drying period and therefore the risk of frost damage and also impede the setting.

Notes regarding St. Astier NHL products:

Products range: St. Astier produces NHL 5 (eminently hydraulic), NHL 3.5 (moderately hydraulic) and NHL 2 (feebly hydraulic). It is a unique range at the disposal of the specifier as it will provide the correct binder for most uses without recurring to blending. The range is completed by the availability of hydraulic lime paints.

Packing and shelf life: All products are packed in heavy-duty bags with intermediate plastic membrane. The shelf life of NHL products is approx. 12 months if stored in dry and ventilated conditions.

Raw material: Consisting only of limestone infiltrated by silica. Only traces of other elements are present. This assures constant uniformity of the final product. The exploitation area extends for about 75 acres with excavation between 25 to 40 feet deep.

Manufacturing process: Totally automated production with capacity of up to 100,000 tons per year. Controlled burning (max. 18500 F) using the purest anthracite coal from Wales to avoid high sulphate contamination and colour alteration. CO₂ tests are continuously performed after burning to regulate slaking. Soundness tests reject substandard materials (over 5/64" (2mm) expansion).

Experience: Established since 1851, St. Astier is supplying reliable products for all building requirements. The St. Astier Technical and Research Dept. conducts strict and continuous quality control on all products. These include tests on compressive and tensile strength, elasticity, adhesion, workability, setting etc.... In the USA and Canada, the St. Astier products are stocked and distributed only through a network of specialist companies, able to assist, if required, in mortar design and application recommendations.