Ionic offer a range of Natural Hydraulic Limes: feebly (NHL 2), moderately (NHL 3,5), 'white' and 'old white' and eminently (NHL 5) hydraulic lime produced to meet the requirements for mortar, render and plaster for conservation, restoration and new build construction. They meet the requirements of BS EN 459-1: 2001 type NHL Natural Hydraulic Lime strength classes 2, 3,5 and 5. They provide a range suitable for use in lime: sand mortars for stone, tile, brick and block laying, external rendering and internal plastering. They provide options for the whole range of climatic conditions encountered in the UK. They are particularly useful in designing mortars and renders to complement the strength of natural stone and soft brick construction. The high degree of whiteness facilitates production of quality architectural finishes and can be pigmented to supplement sand colours and provide matches for restoration work. However when mortars need to be more subdued and blend to existing weather colours and textures the 'old white' NHL3.5 can help achieve these matches.

Applications

Ionic Natural Hydraulic Lime as a binder in mortars can be used for a wide range of applications for pointing, bedding, renders and plasters. Using suitable sharp sand the mortar will have excellent workability and good water retention when applied to most bricks, blocks and surfaces to be bedded, rendered or plastered. The lower strength of natural hydraulic lime mortar compared with Portland cement based mortars allows mixes to be produced which complement the lower strengths of many natural stone and soft brick applications whilst improving plasticity and retaining a high level of cohesion with low shrinkage. Ionic Natural Hydraulic Lime mortars have excellent resistance to sulphates in either ground waters or in masonry. NHL 3,5 and NHL 5 mortars of lime: sand ratios of 1: 2½ and 1: 2 have good resistance to freezing and thawing actions.

General guide to mortar mixes

Construction & Pointing Mortars			
Building material	**Suitable Mortar binder for sheltered conditions**	**Suitable mortar binder for moderate/severe exposure**	**Suitable premixed mortar**
Softer brick or stone	Ionic Lime putty	Ionic NHL3.5	1:3 Coarse Stuff /Lime Green Natural Mortar (NHL3.5)
Good quality brick and stone	Ionic NHL3.5	Ionic NHL3.5 or NHL5	Lime Green Natural Mortar (NHL3.5 or NHL5 grade)
Engineering brick	Ionic NHL3.5 or NHL5	Ionic NHL5	Lime Green Natural Mortar (NHL5 grade)
Medium/dense concrete blocks	Ionic NHL5	Ionic NHL5	Lime Green Natural Mortar (NHL5 grade)

External Rendering Mortars

Background	Suitable Mortar binder for sheltered conditions	Suitable mortar binder for moderate/severe exposure	Suitable premixed mortar
Straw bales	Ionic Lime Putty	Lime Putty (Protection of work necessary)	1:3 Coarse Stuff
Lath or wattle	Ionic Lime Putty	Ionic NHL2	1:3 Coarse Stuff
Softer brick or stone	Ionic Lime Putty Ionic NHL2	Ionic NHL3.5	1:3 Coarse Stuff / Lime Green Duro and Natural Finish
Good quality brick and stone	Ionic NHL3.5	Ionic NHL3.5 or NHL5Hydraulic Lime	Lime Green Duro and Natural Finish
Engineering brick	Ionic NHL5	Ionic NHL5	Ionic Natural Render
Medium/dense concrete blocks	Ionic NHL5	Ionic NHL5	Ionic Natural Render
Light weight concrete blocks	N/A	N/A	Please speak to your Ionic supplier
Fired Clay blocks	Ionic NHL3.5	Ionic NHL5	Ionic Natural Render

Internal Plastering Mortars

Background	Suitable Mortar	Suitable premixed mortar
Straw bales	Lime Putty or Blended Clay	Haired Coarse Stuff & Fine Stuff or Clay Plaster
Lath or wattle	Lime Putty or Blended Clay	Haired Coarse Stuff & Fine Stuff or Clay Plaster
Softer brick or stone	Lime Putty or Blended Clay	Haired Coarse Stuff & Fine Stuff or Clay Plaster
Good quality brick and stone	Lime Putty or Blended Clay or Ionic NHL3.5	Haired Coarse Stuff & Fine Stuff or Clay Plaster or Lime Green Duro and Fine Stuff
Engineering brick	Ionic NHL5 (first coat) Ionic NHL3.5 (second coat)	Prepbond before Fine Stuff. Ionic Natural Render and Fine Stuff
Medium/dense concrete blocks	Ionic NHL5 (first coat) Ionic NHL3.5 (second coat)	Ionic Natural Render and Fine Stuff
Thermalite blocks	N/A	Please contact your Ionic distributor
Gypsum boards or plaster	Prepbond (priming plaster) finish lime putty mix	Prepbond followed by Fine Stuff

Technical guidance on the selection of binders for mortars and renders is available on request from Womersley's Ltd 01924 400651

Quality
Ionic Natural Hydraulic Lime is produced from the natural argillaceous limestone deposits in the quarries at the Izaourt and Sauveterre Works of SOCLI in the South of France. The Quality Control at the works is backed by the extensive central Research and Development facilities of the Calcia Division of the Italcementi Group ensuring a high degree of consistency in performance and colour.

Strength
Very high strength is not normally required of building mortars. An unnecessarily strong mortar will concentrate the effects of any differential movement between the mortar and the brickwork and cracks may appear which could reduce the durability and increase the risk of penetration by rain. A weaker mortar will accommodate some differential movement between the mortar and the brickwork and if cracking does appear it will generally be distributed as hairline cracks in joints, thus preserving the integrity of the stone, bricks or blocks themselves. In general the mortar should be weaker than the masonry units. The use of natural hydraulic lime mortar imparts special properties to mortar of low shrinkage combined with elasticity and allows cracks to heal autogenously by continuing carbonation.

Mortar mix design
Natural hydraulic lime mortars gain strength by a combination of hydraulic action and carbonation. It is essential to consider the mix proportions of mortars with care. The following mix proportions provide a guide from which a mix can be selected to suit the construction and local environmental conditions. Other factors, such as the type of brick or stone, or the sand being used will affect the final mix selection.

Building Element	**Hydraulic Lime Mortar Designation**
Internal walls	HLM 0.5
External walls	HLM 0.5 – 2.5
Facing to solid construction	HLM 1.0 – 2.5
Walls close to/below ground	HLM 2.5 – 3.5
Parapets, sills, lintels and cornices	HLM 2.5 – 3.5
Copings and cappings	HLM 2.5 – 5.0
Chimneys	HLM 3.5 – 5.0
Earth retaining walls	HLM 3.5 – 5.0
Masonry below water level	HLM 5.

HLM Designation	Ionic NHL 2 Lime:Sand (by volume)	Ionic NHL 3.5 Lime:Sand (by volume)	Ionic NHL 5 Lime:Sand (by volume)	Mean Compressive Strength (MPa at 91 days
HLM 5.0			1:2	5
HLM 3.5			1:2½	3.5
HLM 2.5		1:2	1:3	2.5
HLM 1.0	1:2	1:3		1.0
HLM 0.5	1:3			0.5

Notes:
When selecting for mortar strength the effects of sand properties and the water content of the mix should be taken into account. Selection of mortar should take into account any

structural requirements and the properties of the masonry units. The mortar designation (see following table for individual mixes) is for average exposure conditions. Selection must take account of any special local environmental considerations such as prevailing wind, frequency of frosts, location (coastal, hill-side, protected), etc.

Mixing

It is essential that the lime is uniformly dispersed and that any fine agglomerations are broken down. The time of mixing will be controlled by the efficiency of the mixer.
Roller-pan mixers and screed mixers have the most efficient action but simple tilting-drum cement mortar mixers can be used if a longer mixing time is allowed. If the job is sufficiently large use a mixer with a capacity for a full bag of lime. The following sequence will be suitable for a tilting-drum mixer. When mixing wear protective goggles and water-proof gloves.

• Introduce half of the sand and add all of the lime, mix well for 2 to 5 minutes until a uniform colour is achieved.
• Stop the mixer and isolate the drive. Scrape down any material adhering to the back. Add the remaining sand and mix again for 2 to 5 minutes to get uniform dispersion.
• Continue mixing adding water slowly over at least 10 minutes and giving plenty of time for water to be fully incorporated. The mortar should be more like a dough than a slurry and the less water added to achieve this, the better the mortar performance will be.
• The longer the final mixing time the more workable (fatter) the mortar will be. Workability will be improved by allowing mixed mortar to stand for 15 minutes before re-mixing for a further 5 minutes. (In hot weather do not over-mix as water will be lost through evaporation).

Admixtures

Admixtures may be used with natural hydraulic lime mortars, subject to any limitations imposed by the job specification. In particular the use of air-entraining admixture in mortars and renders exposed to severe frost can be particularly beneficial. It is recommended that trial mixes are produced to establish optimum dosage consistent with the required strength.

Additions

Addition of pozzolanic materials can improve the hydraulic activity and performance in some applications of natural hydraulic lime mortars. Materials such as traditionally used crushed brick, Prompt Natural Cement, or metakaolin may be used to increase the mortar strength designation. Addition of Ionic Lime Putty will improve the mix plastic properties but reduce the mortar strength designation. It is recommended that trial mixes be produced to establish the optimum properties for a particular application.

Shelf life

12 Months if kept in a dry environment

Availability

Available in 25kg bags.