



## Specification Guidelines

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### IMPORTANT NOTICE

The company carries out continuous stringent monitoring of the manufacture and performance of the lime which ensures that the material will always perform in a satisfactory manner. However as with any material, performance depends upon following the manufacturer's instructions/recommendations. The company can accept no liability for incorrect use or application.

Recommended 'best practice' must be followed and the lime must not be mixed with materials other than suitable aggregate without obtaining prior approval, in writing, from the company.

## Why Use Roundtower Natural Hydraulic Lime

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There are many reasons for specifying and using Roundtower Natural Hydraulic Limes:

**Old and New** - Roundtower Natural Hydraulic Limes are suitable for building restoration and conservation. Equally, they are well suited for new construction and as mortars, plasters, concrete and grouts.

**Choice** - Roundtower uniquely has 4 different natural hydraulic limes. An NHL 2, two NHL 3.5s (different colours) and an NHL 5. This gives the user the widest choice of material.

**Natural** - Roundtower Natural Hydraulic Limes are natural products. They contain no additives and are not blended.

**No additives** - no need to add pozzolans, cement, plasticizers, water retainers or waterproofers. Roundtower Natural Hydraulic Lime gives consistently high quality results.

**Compatibility & Suitability** – variety of strengths and colours available to suit existing mortar, whatever age.

**Resistance to weather** – quick setting means less need for protection from adverse weather conditions compared to fat lime mortars.

**Resistance to salts** – the absence of gypsum and cement ensures sulphate attack and alkali-silica reactions are impossible. Excellent performance even in marine environments.

**Resistance to bacteria & vegetable growth** – alkalinity of lime inhibits growth.

**Flexibility** - Compressive strength is gained gradually, allowing for movement.

**Elasticity** – no expansion joints, minimal shrinkage and cracking.

**Permeability** – condensation dispersion, reduces rot, and promotes a healthy living environment.

**Insulation** – permeability reduces moisture in structure.

**Low alumina content** - less susceptible to attack by salts.

**Excellent workability** – Free-lime content gives good workability.

**Self-healing** - Free-lime content also gives the mortar self-healing properties.

**Versatility of use** – rendering, plastering, pointing, grouts and other building mortars

**Reworking** – Roundtower Natural Hydraulic limes can be re-worked within 24 hours (8hrs for NHL5) meaning no day joints.

**Recycling** – building materials used with Roundtower Natural Hydraulic Limes can be recovered and re-used.

**CO<sub>2</sub> Absorption** – Natural Hydraulic Lime re-absorbs CO<sub>2</sub> during carbonation of the free lime.

**Examples** – a long list of international reference projects.

**Cost Effective** – low bulk density means good economy as sold by weight but used by volume.

**Customer support** – as a customer of Roundtower Natural Hydraulic Lime, you can expect a comprehensive support and advisory service, which is second to none.

# HERITAGE

## TRADITIONAL BUILDING PRODUCTS

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### Sand Selection

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#### Selecting a Sand

Sand and larger sized aggregates make up the larger proportion of most mortars. Colour, texture and overall strength are all strongly affected by the choice of aggregate.

The aggregates most commonly used with hydraulic lime are sand and grit, although for the purpose of matching historic mortars various impurities may have to be added. A good sand should be a washed sharp sand with angular grains to ensure good bonding qualities. Soft building sands should be avoided as their rounded grain shape can result in excessive shrinkage.

Sands used should be well graded with a range of grain sizes, which for most plaster, render and mortar work will range from 5mm down to 75 micron. Larger sized aggregates may be used in some mortar or pointing work. As a rule of thumb for pointing, the maximum size of aggregate should be no bigger than one third of the joint width. Sands, which contain a clay or silt content of more than 4% should be avoided, as these will inhibit the contact between lime binder and aggregate.

Sands which have a high fines content also be avoided as the larger surface area of these will require more water to be used in the mixing. This higher water content will induce shrinkage and can affect flexural and compressive strengths. Monogranular sands should be avoided as they will possess poor workability qualities and will inhibit good vapour exchange i.e. the ability to breath.

#### Typical sand Grading Examples

General mortar work	Plastering backing coats	Smooth plaster finishes:
% retained on sieve:	% retained on sieve:	% retained on sieve:
5.00mm 5%	5.00mm 0%	5.00mm 0%
2.36mm 8%	2.36mm 6%	2.36mm 0%
1.18mm 16%	1.18mm 22%	1.18mm 8%
600 micron 25%	600 micron 33%	600 micron 10%
300micron 31%	300micron 31%	300micron 32%
150micron 12%	150micron 20%	150micron 32%
<150micron 3%	<150micron 11%	<150micron 18%

### **Sand Void Percentage**

Once you have identified a good local sand, it is worthwhile to establish its void percentage. Knowing the voids in the sand tells how much binder is required in order to fill the voids. Insufficient binder to fill the voids will weaken the material and make it vulnerable to frost damage.

The procedure is simple:

1. Take a container of known volume (a two litre jug or jar is ideal) and fill it level to the top with the selected sand.
2. Remove the sand and dry it completely in an oven on a tray.
3. Replace it in the container to a level top.
4. Take a measured jug of water and gradually add the water until bubbles stop rising and the water has saturated the sand.
5. The void ratio can then be calculated from the amount of water used.  
If for example the amount of water used was approx 30% of the total volume then a mix ratio of 1 part lime to 3 parts sand (by volume) would fill the voids.

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### Mortar Mixing

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#### Mixing your Mortar

A conventional cement mixer can be used, although for larger projects a roller-pan or paddle-mixer is preferable. Lime mortars mixed in drum mixers are prone to balling. However, the following mixing procedure can reduce this problem. It is vital to ensure that when measuring materials this is done by volume. A gauging box or bucket will be necessary for this task. Measuring by shovel is not acceptable since quantities will be inconsistent:

1. Start with an empty mixer.
2. Add 1.5 parts sand
3. Followed by 1 part lime
4. Followed by 1 part sand
5. Mix dry for at least 5 minutes
6. After 5 minutes slowly add water until the desired consistency is reached, it is very important not to drown the mix by adding too much water.
7. Once the desired consistency is reached mix for a further 20 minutes

(The above example is based on a mix ratio of 2½:1).

The mix, to begin with, will appear dry but as mixing time increases the mortar will become much 'fattier'. If too much water is added the risk of shrinkage will increase and the final strength reduced. Do not use any plasticisers.

#### Water Content

The addition of water should be considered carefully, as it will directly affect the ultimate strength and durability of a mortar. The more water introduced into the mortar mix, the weaker will be the final result. However too little water will prevent the chemical processes taking place and weaken the material. Generally, water should be added sparingly, until a useable consistency is achieved.

The masonry background may also affect mortar strength. Dry backgrounds can quickly 'suck' moisture from newly applied mortar. This should be controlled by dampening down the background prior to mortar application.

#### Storage of Lime & Aggregate

Roundtower Natural Hydraulic Limes are supplied in water-resistant paper bags. If the bags are allowed to get wet they may be irreversibly damaged. Also, once opened the exposure to air will start to weaken the hydraulic set. As a result any opened part bags left at the end of the day should be carefully folded over at the top and put into a dry store. In this state the lime will remain useable for a further 2 or 3 days. Thereafter it should be discarded. For larger orders Roundtower Natural Hydraulic Limes are supplied in 1575kg (63 x 25kg bags) plastic wrapped pallets.

Aggregate should also be covered since if left exposed fines can be washed out and the material as a whole can gradually separate.

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### Building/Bedding with Hydraulic Lime

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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 masonry. Cracks may appear which could reduce the durability of the overall wall structure 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, brick or blocks themselves.


In general, the mortar should be weaker than the masonry units. The use of Natural Hydraulic Lime mortar imparts the special properties of low shrinkage combined with elasticity and allows cracks to heal autogenously by continuing carbonation of free lime.


It should be possible to build at approximately the same rate as normally expected for two storey buildings with Portland Cement mortars, but bear in mind the initial set is relatively slow and the mortar will continue to gain strength for many weeks. Good quality masonry workmanship should allow lifts of 8-10 courses of rubble stone masonry per day. Aspect, weather conditions, protection and other factors will influence the speed of set. Sufficient time (1-4 days) should be allowed between lifts.


In building with Natural Hydraulic Lime and masonry units (block, brick or stone) the following points need to be highlighted:

-  The mortar should be well mixed (see Sand Selection and Mortar Mixing method statement).
-  Mortar must not be allowed to dry out too quickly. This is especially important with porous masonry, which will require wetting before construction.
-  Mortar should be used within two hours and left to set. It may be advantageous to brush the surface (where visible) to expose the grit.
-  Do not use if temperature is below 5°C.
-  Be prepared to protect from frost, excessive sunlight and drying winds.
-  With regard to frost protection, driving rain poses less of a risk than rain entering from the top of the wall. The worst combination of ambient conditions for frost attack are, heavy rain directly hitting an unprotected wall followed by clear skies and frost. Saturated walls with just partially hardened

Natural Hydraulic Lime will suffer frost damage more easily than walls protected from the rain. Hessian and plastic sheeting, overlapping on the top c.300mm, will reduce the risk of damage. (See 'Aftercare of Hydraulic Lime Mortars' method statement).

 Lime mortars are designed to aid evaporation. A great deal of the moisture within the masonry units will evaporate out through the masonry joints. This evaporation process causes a drop in the temperature of the wall while drying out. Again, protection is imperative.

 Aggregate mixed with the lime should be clean and free from silt and clay which will increase the water demand of the mortar, reduce its strength, reduce its permeability and increase the risk of cracking in the hardened mortar. (Please refer to 'Sand Selection and Mortar Mixing' method statement).

 Generally, all Natural Hydraulic Limes can be used - NHL2, 3.5, 5 (used in extreme climatic conditions or with v. hard masonry units e.g. granite). For random rubble stone wall construction, Roundtower NHLs are mixed at 2.5 or 2 parts aggregate to 1 part lime. Analysis of existing mortars is important prior to lime selection where conservation of existing materials is preferred.

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### Pointing to Historic Buildings

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#### **Analysis of Original Mortar**

Before carrying out re-pointing work on Historic buildings or structures, determine the type of mortars used in the original building phase. Make sure when removing samples for analysis that they are from an original phase of work, and are not from later remedial works.

The samples should be representative of the bulk of the remaining material. If analysis is needed to determine correct binder, aggregate size, colour and type this can be carried out by Heritage TBP Ltd.

#### **Survey**

Carefully survey the wall to determine the pointing style and condition of the mortar. Notes should be made of open joints, decayed mortar, vegetation and general extent of re-pointing required.

#### **Protection**

Before cutting out of defective mortars, windows, doors, drains, vegetation etc., should be covered and protected. Special care should be given to friable cut masonry and other special features such as antique glass etc.

#### **Cutting out of Defective Mortar**

Considerable care must be taken when removing decayed mortar from historic masonry. When the mortar being removed is decayed or crumbly its removal can be carried out using hand tools. Plugging chisels, masonry chisels and old hacksaw blades used in conjunction with a club hammer will easily remove the mortar.

Never use chisels that are wider than the mortar joint as this may result in damage to the adjacent masonry. The removal of cement pointing will require greater care if damage to the adjacent masonry is to be avoided. If wide joints exist, a series of holes may be drilled through the centre of the joint, which will allow the joint to break inward when tapped with a chisel. On finer joints a tap with a sharp masonry chisel on the top and bottom of the joint will help to break the bond to the masonry at the edge of the joint.

The use of power tools or air chisels should only be carried out under strict supervision and by experienced personnel. Remember that the percussion action of these tools may loosen masonry.

Where lime mortar requires a chisel to remove it, it should be questioned whether its removal is necessary.

### **Depth of Joint**

As a general rule joints are cut out to a depth of twice the height of the joint, quite clearly this rule applies to brickwork, but in the case of rubble masonry this could result in overly deep joints, which may de-stabilise sections of masonry. Therefore a minimum depth of 25mm will allow a good body of re-pointing mortar. Deep joints must be built up in consecutive layers with a minimum of 4 days between coats.

Notes should be taken if pinnings are removed in the cutting out process and these should be retained for re-use.

### **Cleaning the Joint**

Once the joints have been cut out, they should be thoroughly cleaned. Brushing out with a small brush will remove loose mortar and dust, once this has been carried out, the joints should be flushed out with water. This must always proceed from the top, working down the building, ensuring all traces of debris are cleaned down. Where there are deep joints or voids, care must be taken not to flood the core of the wall.

### **Applying the New Mortar**

Before applying the re-pointing mortar, ensure that the joint is well damped down. The new mortar should be stiff and not sloppy, as this will result in shrinkage and leave a smudged and dirty finish. The new mortar should be placed into the joint using a pointing iron or a plasterer's small tool and well packed into the joint. Pointing trowels should be avoided, as this will not allow pressure to be applied across the whole of the joint.

Where there is evidence of stone pinnings or wide joints, the pinnings (small stone chips) should be packed into the new mortar. These will help to avoid overly large joints, which may result in shrinkage. Pinnings will also support weak areas of masonry.

### **Finish Style**

The style of finish will depend on evidence left of the original work, but take care not to replicate styles from later remedial work. On brickwork, struck, weather struck, penny point, flush finish and tuck, are all common. On rubble masonry, it is unlikely to have been a distinct style, as the remains of the mortar are likely to be nothing more than the struck off bedding mortar. Therefore, a joint, which is flush or slightly recessed, will blend with the masonry. The finished joint should be finished by beating the wall with a stiff churn brush once the mortar is fairly stiff. This process also compacts the mortar and leaves an open texture, which will aid evaporation of moisture.

### **Aftercare**

New pointing work should be protected from frost, rapid drying and direct rain for a minimum period of 7 days. See 'Aftercare' statement.

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### Internal Hydraulic Lime Plastering

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#### **Preparation of the Wall Surface**

The successful application, bonding and correct hardening of hydraulic lime mortars, requires that the background should be clean, free from vegetation, free of containments and reasonably dry throughout the wall mass. The wall should be structurally sound and the masonry and bedding mortars in good condition.

The application of various dubbing out coats should not be seen as remedial repair work to the masonry or brickwork background, the replacement of missing or damaged masonry or open joints should be repaired before any plastering of dubbing out coats are applied. Where excessive hollow or unevenness is present the areas should be corrected by use of mortar and stone or brick slips bedded into the mortar, with the aim of presenting a reasonable flat background before plastering commences.

#### **Suction Control and Bonding**

Before the application of any new lime coatings, hydraulic or non-hydraulic, it is vitally important to check to the degree of suction within the background, poor or excessive suction can result in a weak bonding with the substrate caused by rapid de-maturing of the newly applied render, which will result and a weak and powdery interface which will lead to later failure and separation. Where there is little or no suction further action will be required to help bond the coating to the substrate. In situations where suction needs to be controlled, wetting down will be required, on dense blocks or near impervious masonry, simply dampening the surface with a mist spray may be all that is required, but on very porous surfaces such as old brickwork considerable wetting will be required. Wetting the wall by use of a hose, working from the top of the structure, downwards, may need to be carried out the previous day or several times throughout the day before rendering commences. The objective of the suction control is to achieve a thoroughly damp surface, but not wet, i.e., the surface must not have running or standing water remaining on the masonry or brick, this will form a barrier between the coating and substrate, and also lime mortars adhere and stiffen through a certain amount of suction.

On dense or near impervious background, it may be necessary to apply a sand/splatter dash coat to the background to act as a mechanical key.

#### **Salt Contamination**

Where new lime coatings are to be applied to masonry which is salt contaminated, the masonry should be allowed to dry fully before applying new renders. This will allow salt to be detected on the masonry and mortar joint surfaces, if excessive salt is identified clay or lime mortar poulticing may be required. Specialist advice should be sought, if the technique is considered where salt is detected on the mortar joints, rake out the joints to a depth of 50mm, as this is likely to be heavily contaminated and in a weakened condition and repoint (See repointing).

Salt contaminants should never be washed from the surface, as this will result in the crystallized salt returning to a soluble state and retreating back into the pores of the masonry or brick. Where detected on the masonry surface, the salts should be brushed from the surface and cleaned away from the structure.

### **Techniques of Hydraulic Lime Plastering**

The techniques employed in the application of hydraulic lime plasters should be to ensure a correct bonding with the background while striving to minimise shrinkage and rapid drying, these techniques should be followed throughout the plastering process. Lime plastering is generally applied in 3 coats, but it is common to find 2 coats or even single coat work in vernacular or early structures. In 3 coat work the first coat on masonry or brickwork is generally known as the scratch coat or render coat, this coat is applied in a coat of approximately 10mm thickness, this coat can be applied by use of a steel trowel or thrown onto the wall by use of a harling trowel and then flattened in by the steel trowel. When this coat has firmed up but has not gone hard, the plaster is keyed or scratched up to produce a key for the following coats. The keying up is carried out by use of a lath scratcher or similar toothed instrument and care should be taken not to cut through the plaster coat back to the background.

The keying up is generally in the shape of diamonds of approximately 30mm spacing. This coat should be allowed to harden for 72 hours minimum before further coat of plaster are applied, before applying the second coat the first coat should be checked for shrinkage cracks, and these should be filled with plaster before proceeding with further coats, before the second coat is applied the first coat should be brushed down to remove any dust which may have blown onto the surface. The first coat should then be damped down to ensure that the second coat is applied to a damp but not wet surface. This second coat is called the floating coat and is the coat which is straightened to ensure a flat and even surface, after this coat has been straightened; the surface of this coat is scoured up with a timber or polyurethane float (rubbing up with a float similar to finning up render).

The purpose of the scouring is to compact the plaster and counteract shrinkage. This process is generally required to be carried out at least twice, during the scouring up, any small holes should be filled before the finishing coat is applied. This coat should also be allowed to dry and harden for 72 hours before applying the final coat.

After once again damping down the floating coat, the final coat is applied. This coat known as the setting coat, is applied in two layers, coat on coat, with the trowel. This coat is applied in a way similar to skimming. This material should be of a wet enough consistency to allow a long and even spread. Once the setting has been applied, it is scoured in a similar manor as the floating, to counter-act shrinkage and then the surface can be left with a rubbed up rendered type finish or polished smooth with a steel trowel.

### **General Mix Guide**

Backing Coats 1st and 2nd

1 Part NHL2 or NHL3.5 to 2 Parts or 2.5 Parts Washed Sharp Sand  
Use of fibre or hair in these coats is recommended

### **Finish Coat**

1 Part NHL2

1 Part Fine Silica Sand

**Note**

Highly polished surfaces will not allow the passage of moisture as well as an open textured surface.

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### External Hydraulic Lime Render

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#### **Preparation of the Wall Surface**

The successful application, bonding and correct hardening of hydraulic lime mortars, requires that the background should be clean, free from vegetation, free of containments and reasonably dry throughout the wall mass. The wall should be structurally sound and the masonry and bedding mortars in good condition.

Where natural weathering or incomplete repair works have previously been carried out, new repair work will be required to correct these defects. In masonry the natural weathering process can result in the loss of small stones, known as pinnings, which are traditionally placed into wide bed joints between larger stones, where these are missing their replacement should be carried out with any general repointing work which needs to be undertaken. (See repointing).

Where walls are covered in vegetation, lichen or moss, these should be removed, by use of cutting stems, treatment with biocides and eventual cleaning down with brushes, any remaining biological growth can retain water and may in time grow back through the new lime coatings.

The application of various coats of hydraulic lime should not be seen as remedial repair works to the masonry background, the replacement of loose or defective mortar, replacing missing stone pinnings, repairing damaged brickwork or stonework are distinct separate operations and their eventual outcome should be to present a reasonably flat and even surface, which is structurally sound and clean ready for the rendering application.

#### **Suction Control and Bonding**

Before the application of any new lime coatings it is vitally important to check the degree of suction within the background. Poor or excessive suction can result in a weak bonding with the substrate caused by rapid de-maturing of the newly applied render. This will result in a weak and powdery interface which could lead to later failure and separation.

In situations where suction needs to be controlled, wetting down will be required. On dense blocks or near impervious masonry, simply dampening the surface with a mist spray may be all that is required.

On very porous surfaces such as old brickwork considerable wetting will be required. Wet the wall with a hose, working from the top of the structure, downwards, this may need to be carried out the previous day and several times on the day before rendering commences depending on the substrate.

The objective of the suction control is to achieve a thoroughly damp surface, but not wet, i.e., the surface must not have running or standing water remaining on the masonry or brick; this could form a barrier between the coating and substrate.

A certain amount of suction is required for lime mortars to adhere and stiffen so the exact amount of wetting down is decided by the plasterer's experience.

#### **Salt Contamination**

Where new lime coatings are to be applied to masonry which is salt contaminated, the masonry should be allowed to dry fully before applying new renders. This will allow salt to be

detected on the masonry and mortar joint surfaces, if excessive salt is identified clay or lime mortar poulticing may be required. Specialist advice should be sought.

Salt contaminates should never be washed from the surface, as this will result in the crystallized salt returning to a soluble state and retreating back into the pores of the masonry or brick. Where detected on the masonry surface, the salts should be brushed from the surface and cleaned away from the structure.

Scud or Keying Coats – ([See Harling](#))

### **Techniques or render application (2 or 3 coat work)**

The techniques employed in the application of hydraulic lime plasters should be to ensure a correct bonding with the background while striving to minimise shrinkage and rapid drying. These techniques should be followed throughout the plastering process.

Lime plastering is generally applied in 3 coats, but it is common to find 2 coats or even single coat work in vernacular or early structures. In 3 coat work the first coat on masonry or brickwork is generally known as the scratch coat or render coat. This coat is applied at a maximum thickness of 10mm and is applied by use of a steel trowel or thrown onto the wall by use of a harling trowel and then flattened in by the steel trowel.

When the coat has firmed up but has not gone hard, the plaster is keyed or scratched up to produce a key for the following coats. The keying up is carried out by use of a lath scratcher or similar toothed instrument and care should be taken not to cut through the plaster coat back to the background.

The keying up is generally in the shape of diamonds of approximately 30mm spacing. This coat should be allowed to harden for 72 hours minimum before further coats of plaster are applied. Before applying the second coat the first coat should be checked for shrinkage cracks, and these should be filled with plaster before proceeding with further coats. The first coat should be brushed down to remove any dust, which may have blown onto the surface. The first coat should then be damped down to ensure that the second coat is applied to a damp but not wet surface.

This second coat is called the floating coat and is the coat, which is straightened to ensure a flat and even surface, after this coat has been straightened; the surface of this coat is scoured up with a timber or polyurethane float.

### **Surface Finish**

Where possible the texture of the finished surface should be left slightly open or coarse, as this will allow better evaporation of moisture from the surface; the finished work should not be closed or “trowelled” up with a steel trowel.

### **Day-Joints**

Where day joints are unavoidable they should be hidden wherever possible behind down-pipe runs or over the shortest possible areas. When working with Roundtower NHL2 or NHL3.5 mortars the reworking of the joint is usually achievable the next day by lightly spraying the surface with water and rubbing up the joint with a wooden or polyurethane float, if this process proves difficult cut away approximately 50mm of the previous days render, it is this perimeter zone which is most open to the air and will therefore dry first.

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### Hydraulic Lime Harling / Wet Dash / Roughcasting

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#### **Introduction**

The lime coating known as harling wet dash or roughcast is the most commonly applied external finish to be found on vernacular architecture in Ireland. The harling material is a combination of aggregates and lime, mixed into a slurry consistency and applied in a fluid state. Historically the harling was applied directly onto the masonry walls which had previously been evened out by pointing the wall flush and filling small holes with stone pinnings and mortar. Towards the end of the nineteenth century it became commonplace to apply one or two towelled undercoats to flatten the background before casting on the lime harling.

An extension of this practice became known as dry dashing or pebble dashing, where dry shingle is cast into a wet adhesive coat. However, in traditional harling the finish coat is applied directly to the masonry background.

#### **Preparation of the Masonry Background**

Successful application of lime harling depends greatly on the amount of preparation that is carried out on the masonry background. External lime coatings are generally applied in relatively thin coats, therefore any masonry defects in the form of hollows or missing pointing must be corrected before the application of the harling coat. The correction of these defects should be carried out during masonry preparation and not rectified through coats of "dubbing out". Areas of varying thickness are prone to shrinkage, carbonation and curing problems. Careful background preparation plays a vital part in the weather resistance capability of the wall.

Materials to be used in background preparation, should, wherever possible, be matched to the existing fabric. In doing so, the repair will be compatible and produce a similar performance pattern. Where previous remedial work has taken place with unsuitable materials, (i.e. dense cement mortars), these should be removed and repaired with matching mortars or stone.

The background must be free from dirt, grease and vegetation. These elements should be removed several weeks before repairs are underway. The removal of biological growths should be thoroughly carried out, as any remaining lichen, algae, etc, will grow back and attack the bonding between lime finishes and the background.

#### **Suction Control and Bonding**

Before the application of any new lime coatings it is vitally important to check the degree of suction within the background. Poor or excessive suction can result in a weak bonding with the substrate caused by rapid de-maturing of the newly applied render. This will result in a weak and powdery interface which could lead to later failure and separation.

In situations where suction needs to be controlled, wetting down will be required. On dense blocks or near impervious masonry, simply dampening the surface with a mist spray may be all that is required.

On very porous surfaces such as old brickwork considerable wetting will be required. Wet the wall with a hose, working from the top of the structure, downwards, this may need to be carried out the previous day and several times on the day before rendering commences depending on the substrate.

The objective of the suction control is to achieve a thoroughly damp surface, but not wet, i.e., the surface must not have running or standing water remaining on the masonry or brick; this could form a barrier between the coating and substrate.

A certain amount of suction is required for lime mortars to adhere and stiffen so the exact amount of wetting down is decided by the plasterer's experience.

On dense or near impervious background, it may be necessary to apply a sand/splatter dash coat to the background to act as a mechanical key.

### **Salt Contamination**

Where new lime coatings are to be applied to masonry which is salt contaminated, the masonry should be allowed to dry fully before applying new renders. This will allow salt to be detected on the masonry and mortar joint surfaces, if excessive salt is identified, clay or lime mortar poulticing may be required. Specialist advice should be sought.

Salt contaminates should never be washed from the surface, as this will result in the crystallized salt returning to a soluble state and retreating back into the pores of the masonry or brick. Salts should be brushed from the surface and cleaned away from the structure.

### **Techniques of Application**

New applications of lime harling are generally applied in 2 coats with an approximate thickness 8mm to 6mm respectively, single coats can be applied, but it must be remembered that these thin coats will not have the same durability. The overall thickness will of course be effected by the size and shape of the aggregates used. To replicate a traditional harled finish, the selection of tools used and method of application is essential. The best tools for harling are the purpose made harling or scudding trowels (many plasterers use a small coal shovel with great effect), these tools allow an even spread of material over the whole blade of the trowel, which helps with an even coat of material against the wall. The technique of application requires that a small amount of the lime harling is scooped up with the trowel, and with a flick of the wrist dashed against the wall. This method requires a degree of practice to achieve an even material thickness. Forehand and backhand casting techniques will allow difficult and awkward areas to be reached and ensure total coverage. Variation of texture and pattern are typical of traditional harled finishes and are an indication of different casting techniques and style of tradesman's personal preference.

Machine applied sprayed finishes have been introduced into lime finishing, and although their performance is technically sound, the finished work bears little resemblance to a traditional finished harl.

### **Harling up to Details**

Where details such as stone quoin of window dressing are encountered, which stand proud, the harling can be tucked neatly behind the finished edge, this will protect

against water penetration, where stone details have no distinct edge the harling can be feathered out, this can be achieved by using progressively thinner material.

### **Harling Finishes**

It is generally considered that there are 2 distinct styles of finish to lime harling, the first style is the "as cast" style, where the material is simply left as cast onto the masonry without any further adjustments, the second style is a flatter finish in which the cast harling is pressed back against the wall with the aid of a timber float to even out the surface. Both styles are traditional and choice of finish should follow existing examples.

### **Health and Safety**

Harling by its nature of application carries a risk factor, and therefore personnel should wear protective equipment, particular attention to be given to eye and skin protection.

# HERITAGE

## TRADITIONAL BUILDING PRODUCTS

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### Aftercare of Hydraulic Lime Mortars

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#### Protection and Curing

After the application of lime renders, plasters or coverings, controlled curing and protection will be needed to ensure maximum strength and durability are achieved. The chemical reaction which gives hydraulic lime its long-term performance is known as the 'hydraulic set'. 'Carbonation', (the reabsorption of carbon dioxide), also takes place. This process is best achieved in warm and moist conditions, which allows the new works to dry slowly. Therefore, during and after completion of the work, it is essential to ensure ambient conditions.

Rapid drying by the sun, wind or artificial heat will all have a detrimental effect on the final outcome of the lime finishes.

Temperatures below 5°C will slow the carbonation and hydraulic setting process and frost conditions will damage un-carbonated areas, through the action of freeze-thaw (expansion/contraction) resulting in feeble and crumbly finishes.

Excessive shrinkage is a result of rapid drying, and this can lead to separation between coats and background. Rapid drying of the surface of new mortars, can also lead to the pores of the mortar becoming blocked with fine material, transported to the surface by the passage of water evaporation too quickly from the mix, this will inhibit the carbonation process taking place deeper into the new mortar.

The best way to control and protect the carbonation process is to form a microclimate for the new work. Where the new work is scaffolded, this can be a reasonably simple job. Scaffold netting is very useful for reducing the effects of wind. In addition to this in warm or hot conditions, damp hessian can be placed against the new work and then covered by sheeting to stop rapid drying.

New work should be damped down for a minimum period of 10 days after completion and longer if possible. The emphasis should be on damping down as opposed to saturating new work. Provision should be made for damping down over weekends, holidays etc. In cold weather, the work must be protected from frost attack, by using thermal blankets e.g. polystyrene sheets. Hydraulic plasters/mortars will stand up to cold conditions after 3-4 weeks of hardening. It should be remembered that prolonged periods of cold temperature will slow the overall hardening process and extended periods of protection will be called for.