

MASONRY RESTORATION

Lime Putty & Hydraulic Mortar Repointing Guide

1.0 Wall Preparation for Repointing

1.1 Tools & Approach

A. Power Tools - When used in a controlled way, power tools with diamond-impregnated metal blades and a maximum 1/8-inch-thickness / 4-inch diameter — can be very helpful in the mortar removal process. CAUTION! When power tools are used to clean out the entire joint, often in two passes and edging the top and bottom sides of the masonry units, irreversible damage occurs.

B. Center-Cut Method (CCM) – The CCM is a combination of power-tool and hand-chiseling techniques for successfully removing existing mortar from a wall without damaging the masonry units. The CCM allows the use of power tools to remove existing mortar joints — if the width of the existing bed joint is at least 3/8 inch. The CCM was developed to protect existing masonry units and joint profiles by eliminating contact between cutting blades and masonry units. **Use on horizontal joints only.** Center cutting of the vertical head joints should not be allowed. Once the center is cut from the joint, the top and bottom of the mortar between the masonry units can be easily removed by carefully using a five-in-one, a chisel and hammer, or pneumatic carving tools.

Strictly adhere to a written quality-control program to prevent damage due to worker fatigue. The quality-control program should include provisions for demonstrating the ability of operators to use power tools without damaging masonry, for supervising performance, and for preventing damage due to worker fatigue.

C. Hand Chiseling – It's wrong to assume that mortar removal with hand tools causes less damage to masonry units than using power tools. The use of five-in-ones, tile scrapers, and chisels and hammers **can cause irreversible damage.**

D. Raking Out Lime Mortar - Soak the joint with water to soften the lime mortar before removal. Rake out or scrape the mortar by hand with a five-in-one or a chisel and hammer. Lime mortar removal does not typically require power tools.

1.2 Mortar Removal

A. Depth of Removal – Rake out joints to a minimum depth of 2.5 times the width of the existing mortar joint but not less than that required to reach sound existing mortar. To avoid compromising the structural stability of the wall, the joint should not be raked out more than half the width of the masonry unit.

Examples:

1/16" Mortar joint needs to be cut out to a depth of 3/16" minimum

1/8" Mortar joint needs to be cut out to a depth of 5/16" minimum

MASONRY RESTORATION

Lime Putty & Hydraulic Mortar Repointing Guide

- 1/4" Mortar joint needs to be cut out to a depth of 5/8" minimum
- 3/8" Mortar joint needs to be cut out to a depth of 15/16" minimum
- 1/2" Mortar joint needs to be cut out to a depth of 1-1/4" minimum
- 3/4" Mortar joint needs to be cut out to a depth of 1-7/8" minimum
- 1" Mortar joint needs to be cut out to a depth of 2-1/2" minimum

B. Square Back Reveals - Remove existing mortar from masonry surfaces within the raked-out joints to provide reveals with square backs and to expose masonry for contact with the repointing mortar. Brush, vacuum, or flush the joints with water to remove dirt and loose mortar. Do not spall or chip masonry units in the process of mortar removal.

C. Featheredging - For the long-term performance and appearance of the replacement mortar, do not feather the edge of the existing mortar. Featheredging happens when a joint has not been raked out deep enough, when square-back corners have not been cut, or when the grinding wheel is removed from the joint. To promote bonding between the existing and the replacement mortars, the meeting point should be clean-cut at a 90-degree angle.

D. Changing the Visual Appearance of the Wall - Do not widen the existing masonry joints by cutting into the surrounding edges of the masonry units.

2.0 Mixing & Application

2.1 Mixing

Mortar should be mixed according to the manufacturer's recommendations. The mortar material should resemble the consistency of brown sugar during installation. This drier consistency allows the material to be tightly packed into the joint, provides for cleaner work, and prevents shrinkage cracks as the mortar cures.

2.2 Application

A. Weather - Do not perform any masonry work unless air temperatures are between 40 degrees Fahrenheit (10 degrees Celsius) and 95 degrees Fahrenheit (32 degrees Celsius) and will remain so for at least 5 weeks after the completion of the work.

B. Presoak Masonry Wall – Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time the rinsing applications so that the joint surfaces are damp but free of standing water when it is time to point. If the rinse water dries, dampen the masonry-joint surfaces before pointing.

C. Back Pointing – The replacement mortar should be applied to the deepest cut/deteriorated areas in the existing mortar first.

MASONRY RESTORATION

Lime Putty & Hydraulic Mortar Repointing Guide

D. Layers – Mortars for repointing can be applied in single lifts up to a maximum one and one-quarter inch (1-1/4 inch or 9 mm). When the depth of the mortar application exceeds 1-1/4 inch, then divide the application depth by two – for example a joint depth of 1-1/2 inch can be pointed in two 3/4-inch layers. Fully compact each layer and allow it to become thumbprint hard before applying the next layer. “Thumbprint Hard” is when the applied mortar has dried enough that it is tight when you touch it with your thumb or finger.

E. Placing Mortar – After the deepest areas have been filled to the same depth as the remaining joints, point all joints by placing mortar in layers not greater than one and one-quarter inch (1-1/4 inch or 9 mm). *Fully compact the mortar into the joint. Overfill the mortar past the face of the masonry units but do not allow it to spread over the edges onto the masonry surfaces.* Do not featheredge the mortar. Where existing bricks or stones have worn edges, slightly recess the finished mortar surface below the face to avoid widened joint faces.

F. Finishing Mortar – *When the mortar is thumbprint hard, remove excess mortar from the edge of the joint by cutting with a trowel or raking tool.* Match the original joint profile and finish. The point at which the mortar becomes thumbprint hard will depend on several factors: the mortar formulation, weather conditions, rate at which the masonry units absorb water, the application depth, and the width of the joint.

Lime mortar can often be finished within hours of installation or the following day. Follow the mortar manufacturer’s recommendation regarding the timing for finishing the joints. The joints should be finished to match the original historic joint profile. The use of a churn brush to stipple the joints is recommended. Finishing the joints with a steel concave striking tool is not recommended.

3.0 Carbonation & Curing

3.1 Carbonation

A. Setting Time – Lime mortar sets by carbonation rather than by hydration and requires more time to set than does Portland cement mortar. During carbonation, the mortar hardens as the lime putty slowly converts back to limestone by absorbing carbon dioxide from the atmosphere. It is necessary to initiate the carbonation process by water misting the material after the tooling of the joint profile has been completed. Nine (9) complete wet-and-dry cycles are required usually within the first three days after application.

B. Speed of Carbonation – The speed at which the carbonation process initially starts depends on the ability of a masonry wall to dry out as it releases moisture by evaporation. Carbon dioxide is pulled into the mortar as the moisture evaporates from the surface of the joint. Air temperature, wall surface temperature, direct sunlight, air circulation, application width and depth, and the tooling style will dictate

MASONRY RESTORATION

Lime Putty & Hydraulic Mortar Repointing Guide

the frequency of misting and the length of time required to complete the nine wet and dry cycles. Water misting is still necessary in wetter climates, but the amount of water used will vary as will the timing between water misting applications.

3.2 Curing Methods

A. Methods – Acceptable curing methods include covering the repointed wall with plastic sheeting, periodic hand misting, and periodic mist spraying using a system of pipes, mist heads, and timers. Adjust curing methods to ensure that the pointing mortar is damp without eroding the surface of the mortar. Curing methods will vary in different parts of the country and at different times of the year, calling for different amounts of water to be used in the wet-and-dry cycles. Adjustments also have to take into account how much time is remaining before freezing weather arrives.

It is important to note that keeping the wall in a damp condition for 72 hours, which is a common instruction in specifications for cement-based mortar, provides no benefit at all and will slow the carbonation process. The wall must be allowed to dry out and then be misted with water again to initiate the carbonation process.

B. Wet & Dry Cycles – The carbonation of lime mortar initially requires these cycles, which can be created by water misting the joints after the mortar application. The joint profile should be finished before these cycles are started. Water misting should be carried out until a full nine (9) alternating wet-and-dry cycles are completed. If weather conditions permit the work to dry between mistings, the nine (9) wet-and-dry cycles can usually be completed immediately after installation by water misting the repointing work three times per day for three days. It is more practical; however, to specify the number of cycles required because weather conditions vary. Nine wet-and-dry cycles may take only two days or several weeks depending on the conditions of the wall and the environment.

C. Protection – Keep the mortar from drying out too quickly or from becoming too wet. Protect it from direct sun and high winds for the first 72 hours after installation or from driving rain for the first 24 hours, using plastic sheeting if necessary. Be careful not to create a greenhouse effect by sealing off air movement in an attempt to protect the wall with plastic. Air circulation is important in the carbonation process.

4.0 Cleaning

4.1 Timing

A. Tools & Method – When possible, it is better to clean existing masonry before repointing. When repointing work precedes the cleaning of existing masonry, allow the mortar to harden to the point that cleaning can be accomplished without eroding the surface of the mortar. This can be carried out as early

MASONRY RESTORATION

Lime Putty & Hydraulic Mortar Repointing Guide

as three days after repointing is finished and as long as one month later depending on the curing conditions. After the replacement mortar has fully hardened, thoroughly clean the exposed masonry surfaces of excess mortar and foreign matter. Use wood scrapers, stiff-nylon or fiber brushes and clean water that is spray-applied at garden-hose pressure.

Do not use metal scrapers or brushes.

Do not use acidic or alkaline cleaners.

5.0 Common Problems

5.1 Cleaning Chemicals

A. Muratic Acid – The use of Muratic or other acid-based cleaners can cause discoloration in lime mortars to a greater degree than they do to Portland cement mortars. Because lime mortars are more porous, they grab the cleaners and pull them into the body of the material faster than do cement mortars. The cleaners cause early deterioration of the lime and discolor the mortar. Recent trends in masonry restoration techniques to —tone down or to —expose the aggregate of newly installed restoration mortars using Muratic acid in field-mixed solutions or brand-name cleaners containing acidic materials **are not** recommended. While these trends create the visual effect of an aged mortar joint, the life cycle performance of the joint may have lost 15 to 20 years. Other techniques are now available to create an aged visual appearance of the new joint without the use of acidic solutions.