



# Lancaster Lime Works

## Lime Putty Mortar Installation Guide for Pointing and Bedding Mortars

Installing Lime Putty Mortar is not difficult; it is just different than installing modern cement

# Installation Guide

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## Thank You For Purchasing From Lancaster Lime Works!

Our products are formulated from the results of decades of research and testing both in the laboratory and in real buildings of all kinds across America. Our natural, carbonating, non-hydraulic lime is manufactured according to very stringent standards to produce a lime putty that is comparable to the longest lasting mortars of the world, technology that took thousands of years to develop.

Only in the last few decades have these historic mortars been understood in the context of modern materials science. What was once a closely guarded, secret technology that only a few possessed is now available to anyone who is willing to learn.

We are confident that, if you follow correct installation procedures as outlined in this Guide, these products will provide superior performance and a very long life, just as they have for thousands of years wherever the finest, high-calcium lime putty was made.

## Introduction To LLW Lime Products

Lancaster Lime Works™ products (including lime putty, lime stucco, lime mortar, and limewash) are made from “natural lime”. They are a carbonating, non-hydraulic lime, which means that they do not have the “setting” component that natural hydraulic limes (NHL), natural cements, and Portland cements do.

And yet, natural lime can be used by itself with sand as the “binder” in mortar, stucco, and plaster because it produces a chemical reaction that causes it to harden without cement. The result is masonry products that are comparable in strength, but superior in flexibility and moisture permeability to most other types of binders.

Hydraulic means a product will get hard as the result of combining it with water will set under water. Non-hydraulic means that a product does not get hard as a result of being combined with water.

The LLW™ products (listed above) are non-hydraulic, natural lime products. They get hard as the result of drying and being exposed to carbon dioxide (CO<sub>2</sub>). Keeping them under water seals them away from carbon dioxide, where they will remain in a wet state indefinitely.

When non-hydraulic, natural lime is exposed to carbon dioxide and allowed to dry, the calcium reacts with the CO<sub>2</sub> in the air in a process called carbonation, forming crystals around and between the particles of sand. This produces a hard, cement-like finished product that is actually man-made calcareous (kal'ker'ē'əs) sandstone.

Natural lime can be used alone as the binder in mortar or plaster, without the addition of any cement or other hydraulic product. As long as the correct procedures are followed, it will become hard, strong, flexible, durable, and breathable in most situations. Pozzolan can and should be added in certain severe applications.

It is important to note that Type S lime, otherwise known and sold as mason's lime, is not usable alone as a binder in mortar or plaster, but is only suitable as a plasticizer. It is typically used with Portland cement to improve the workability of the mortar or plaster. It will not harden or set at all, and if used alone as a binder, will deteriorate quickly in exterior applications.

Because natural lime is different from all other binders commonly used for mortar (including hydraulic limes and cements), the techniques for installation are different. Working with these products takes experience and understanding, which this Guide will help you to acquire. Installing them is not more difficult; it is just different from the techniques that are typically used for hydraulic products. Once these techniques are understood, natural lime products can be used in all kinds of architectural situations, even where other products would fail.

Our objective is that this **Installation Guide** will rapidly accelerate your understanding of correct lime mortar installation techniques. It is the combination of decades of testing in all different construction situations, and will be a reliable and trustworthy guide for you in your use of the Lancaster Lime Works™ products.

These products have been successfully installed in hundreds of old and new buildings, and have proven to be very reliable and very long lasting, if installed properly.

Reading, understanding, and following this Guide is essential to a successful installation of Lancaster Lime Works™ products. Because the technology of natural lime has fallen into disuse and is rarely understood, even by otherwise competent masons, architects, and conservationists, natural lime products are often misunderstood and treated like hydraulic products.

Remember, all hydraulic masonry products, including hydraulic limes (NHL), natural cements, and Portland cements, have some percentage of calcined (burnt) minerals (usually clays) that will get hard and “set”.

These non-hydraulic limes get hard through a different chemical process, so a different installation process must be followed. The rest of this guide will clearly explain the correct installation techniques for natural lime products in different situations.

## The Fundamentals of Using Lancaster Lime Works™ Products

### 1. SAFETY.

Working with natural lime products requires the use of safety precautions and personal protective gear.

**Lime is extremely caustic when it is wet.** It has a very high pH (12), which will burn the skin and eyes. It is absolutely required and essential to protect yourself and all of those in the vicinity of any open lime products or the tools used for installation.

Avoid skin contact. Long sleeves, gloves and long pants should be worn at all times to protect the skin during installation. Those mixing the product by hand or with mechanical mixers should also protect the whole face with a full-face shield. Eye protection should be worn at all times during mixing and installation.

Please consult the Material Safety Data Sheets for more information.

Once carbonated, lime becomes pH neutral. Ordinary vinegar will neutralize the lime, so keep plenty of it close whenever using the lime products. Always flush eyes with clean water.

### 2. MONITOR MOISTURE.

Monitoring the movement of water in and through masonry is important to the successful installation of natural lime products. The job of the installer is to observe the moisture level in the substrate (material to which the lime will be applied) and in the finished installation at all times, even over evenings and weekends.

Carbonation, the process whereby the mortar or plaster gets hard, occurs as the water moves out. The mortar must be allowed to dry out, but not too fast.

### 3. LET IT DRY.

Lancaster Lime Works™ Natural Lime must be allowed to dry out or the CO<sub>2</sub> (carbon dioxide from the air) will not have access to the lime to cause it to harden. CO<sub>2</sub> moves in as the water moves out. Keeping a wall too wet, or keeping it wet for too long prevents carbonation. Thoroughly dampen the substrate, and then let the installation dry slowly. Rain helps carbonation because it contains dissolved CO<sub>2</sub>.

### 4. THOROUGHLY DAMPEN THE SUBSTRATE.

“Substrate” means the wall or backing material to which the mortar or stucco or lime wash is to be applied.

Lancaster Lime Works™ Natural Lime must not be allowed to dry out too fast. Dry, porous materials, such as dry bricks, dry mortar, dry sand, dry wood, and dry stones, have a very strong suction. When natural lime mortar is used with very porous bricks, or against any dry, porous

material, the water will be sucked out of the mortar very quickly. That suction will stop the proper carbonation process in the mortar, causing the mortar or stucco to become soft and crumbly. Once this happens, it is ruined and must be removed.

It is essential that the substrate (materials behind or under) be thoroughly wetted so that the water in the mortar can leave slowly into the air and not be sucked out from behind or underneath. This takes time, and must be taken seriously and planned into the job. If the wall that is being pointed, chinked, plastered, stuccoed, or limewashed is not thoroughly dampened, the installation will **fail**.

**It is not enough to spray the wall down once or twice. It takes hours on thick, dry masonry walls to dampen the wall adequately. One test is to mist the wall and then notice what happens on the surface as soon as the misting stops. If it instantly dries up, there is still too much suction to successfully apply natural lime. If the water hangs there for a few seconds and the surface stays glistening, then you may have applied enough water.**

## **5. PROTECT YOUR INSTALLATION FROM FLASH-DRYING.**

Freshly applied mortar or stucco should be protected from drying winds, direct sunlight, and any environmental condition that causes rapid evaporation. Plastic or burlap can be used to break wind and shade a wall.

The best policy is to follow the sun around a building rather than letting the sun follow you. In other words, work on the south and west sides early in the day, and on the east side in the afternoon. Protect the sun side during the heat of the day, and mist areas that are drying too quickly.

**Experience is the final test in monitoring the moisture level, but here are some things to look for:**

- Always be alert for your material “flash-drying” once it is applied. Flash-drying here refers to the surface (mortar, stucco, or limewash) turning white and becoming dry to the touch quickly (within a few hours or less of) when it is applied.

- When the substrate is not thoroughly dampened, or when there are very dry weather conditions or wind, new applications of lime products will dry out too quickly. When this happens, the surface will become very white or light in color and dry to the touch. When this dry crust is scraped off, the material behind it will often be soft and powdery. This is a failed installation and should be removed and redone.

- If the product is drying very fast, take the time to dampen the wall more thoroughly before continuing to apply, and protect the application from direct sunlight and drying winds using burlap or plastic sheeting.

- LLW Lime Products should dry out slowly and evenly over a 24-48 hour period.

- When an installation dries properly, the color of the finished product will be similar but slightly lighter than the wet product. Flash-drying causes it to be several shades lighter or white.

- Very thin coats of stucco or pointing very narrow joints (BUTTER JOINTS) are the most difficult to monitor. Pay careful attention to these types of installations. Start with a small area in order to get the correct amount of moisture, and don't be afraid to start over if it flash-dries.

- If areas of the installation are drying faster than others, mist them with pure water from a garden sprayer. Often in the summer, surface misting should be done a few times over the first 24 hours depending on environmental conditions. More or less may be needed.

## **6. PROTECT YOUR INSTALLATION FROM FREEZING.**

Lancaster Lime Works™ products must be kept from freezing once they are installed. New installations must be protected from freezing for as long as it takes to dry out and carbonate. This will be variable, depending upon the thickness of the installation and the environmental conditions.

Water behaves differently below 40° Fahrenheit (4° C.), so evaporation and carbonation are much slower. There is no magic number of hours that it takes for natural lime products to cure because it depends on the amount of moisture in the masonry, the moisture in the air, the temperature, air movement, and the thickness of the application.

It is best not to attempt an installation unless temperatures will be predominately above 40° F. for at least two weeks AND the material is protected from any danger of frost. The installation should be uncovered above 40 degrees F. to allow proper drying and carbonation. The best temperatures for installation are between 40 and 70 degrees Fahrenheit.

## **7. SAND IS VERY, VERY, VERY IMPORTANT.**

Lancaster Lime Works™ Natural Lime must be mixed properly. Until you are very familiar with the correct procedures of mixing your own lime putty, we strongly recommend using a Lancaster Lime Works™ premixed mortar or stucco.

The following factors are critically important in formulating a successful mortar or stucco:

The lime/sand ratio, which varies from sand to sand

The shape of the sand particles.

The correct ratio of sand particle size, called particle size distribution.

The amount of water.

Sand provides the strength of the finished product. It is essential that the sand has certain characteristics, mentioned above. If the sand does not have these characteristics, the installation will probably not be successful, or will not last.

The sand must be properly graded and composed of a mix of sub-rounded and sub-angular particles. Crushed rock aggregate, no matter how fine will not perform well with natural lime. Very rounded sand will not perform well with natural lime. The sand used must be reasonably sharp, with the right mix of particle sizes.

The right ratio of lime to sand is determined by a simple test to find the total amount of space in between the particles of sand. This is called the void space ratio. The strongest mix is made by using just enough lime to coat each particle of sand, which fills these void spaces between the sand. Using more than this creates a mortar that will compress under pressure (low compressive strength). Using less than this will not adequately bind the sand together, and it will tend to erode easily.

If it is your first time using Lancaster Lime Works™ products, we recommend using one of our premixed mortar or stucco products because they are blended with a carefully chosen sand in the right ratio.

If you do decide to mix lime putty with sand yourself, please contact us for more instructions.

## **8. DON'T APPLY TOO THICK OR TOO THIN.**

When used as a parging or stucco, Lancaster Lime Works™ Natural Lime must not be applied too thick or too thin. If thick, it will eventually carbonate, but will take a much longer time to get hard than if the material is applied in thinner layers and allowed to carbonate before another is applied. This would not apply to bedding mortar, but to plaster and stucco. Apply stucco coats that are 3/8" to 5/8" thick.

If applied too thin, the natural lime mortar or stucco will tend to dry out too quickly. Applying at least 3/8" thick helps to avoid premature drying. Thin coats are touchy and must be watched closely to make sure they don't flash-dry.

When used as a bedding or pointing mortar the joints must be filled completely rather than in lifts. Pushing the mortar with force as to compress the sand very firmly. This is critical for a successful installation.

## **9. ABOUT WATER.**

Lancaster Lime Works™ products are made with pure, potable water. Any water that is used by the installer for dampening the substrate, misting the installation, or mixing should be potable and free of chlorine, iron, and pollutants. Chlorine will evaporate from water if left to stand in open containers for a day. Water filters should be used where water sources are polluted.

## **10. USE IT DRY.**

The carbonation process works best if the product is used in the driest state that is workable. Excess water leads to shrinkage. Watered down, thin mortars and plasters must be compressed as they dry to keep them from shrinking. Get used to working with as dry a mortar as possible while adequately dampening the substrate.

This is a very different working experience for masons that are trained in laying brick with Portland mortar, but it is important and it's easy to get used to. Wet your bricks first by dipping or soaking in water, depending on how porous they are. Let them stand for a few minutes out of the water before laying so that the faces can dry. With dampened bricks and stiff mortar, the bricks are easy to level and adjust, and require much less attention later to keep the mortar from flash-drying.

If the mortar is overly stiff, which it will be when it sits for an hour or more, water should not be automatically added to thin it down. The solution for overly stiff mortar is to re-mix it with a powerful drill mixer in a bucket. This works it back into a smooth workable mix. Beating it with a 2x4 cutoff in the mud pan, or repeatedly dropping it onto the hawk can accomplish the same effect. Or remix in a vertical shaft mixer just prior to installation.

We recommend pouring the water off the top of premixed mortar or stucco before use. Save the pour-off water in a bucket in case small amounts need to be added back later.

If the mortar is made too wet, spread it out on a piece of plywood placed at an incline to allow excess water to run off, soak into the plywood, and evaporate slowly. Do not leave the mortar like this unchecked for more than an hour or carbonation may begin.

**The next page is a summary of the 10 Fundamental Points above.  
PRINT IT OUT AND REVIEW IT EVERY DAY.**

# **The Fundamentals**

**“Down & Dirty”**

- 1. Lime is extremely caustic when it is wet—protect your eyes and skin. Protect objects and people below.**
- 2. Monitor the Moisture. This is your main focus before, during, and after installation.**
- 3. Thoroughly dampen the substrate starting 24 hours before.**
- 4. Install with pressure. Don't slick.**
- 5. Be prepared for problems and provide extra protection in hot and cold weather. Curing stops below 40° F.**
- 6. Let it dry out slowly over 24-48 hours.**
- 7. Sand is very, very, very important. Buy the pre-mix or know what you're doing before you mix.**
- 8. Keep stucco coats between 3/8” and 5/8” thick.**
- 9. Use clean water for misting and mixing.**
- 10. Use mortar and stucco as dry and stiff as possible.**

## Pointing Mortar Installation Instructions

1. Become very familiar with the Fundamentals, above.
2. Use personal protective gear, including eye protection and skin protection. Have white vinegar nearby to neutralize spills.
3. Protect horizontal surfaces around and below the work area. Lime mortar will corrode aluminum, copper, and other metals. Painted surfaces may be damaged also. Wood surfaces will be stained by it.
4. Remove the existing joints to a depth that equals twice the width of the joint. A 3/8" wide joint would need to be removed to a depth of 3/4". Very narrow joints, sometimes called butter joints, should be removed to a greater depth to allow for a deeper application. Power tools can be used for removal, but it is not recommended, as it is easy to damage the masonry units. If using power grinders, center-cut the joint and finish the removal with a chisel. Head joints (vertical) require extreme care with power tools.

Very hard or non-porous mortars, especially Portland cement mortars, should be removed entirely if possible. These mortars tend to stop or restrict the movement of water in the masonry, so thoroughly dampening the masonry units (bricks or stones that the wall is built of) will be more difficult.

For sand-blasted or very narrow butter joints, a latex mask or cleaning poultice can be applied to the faces of the bricks to keep the brick faces clean and speed installation of the mortar. This is best applied before joint removal, but can be applied after joint removal. Masks restrict the dampening process, so dampen walls before applying, or be more thorough in applying water to the joints. Once the pointing is completed in an area, remove the mask immediately.

5. Thoroughly dampen the wall to be pointed. This requires regular slow wetting of the wall with a hose and a misting nozzle or a garden sprayer over a period of 12-24 hours prior to pointing. Make sure the water is going all the way to the backs of the joints and not just running off the faces of the bricks or stones. Use non-chlorinated, unpolluted water.

6. Before pointing, assess the moisture level in the masonry units and at the back of the joints. It should seem damp. Putting a hand flat on the surface of the wall should indicate that the wall is slightly cooler than the air. Ideally, the surface of the wall is not wet, because this makes it difficult to point without smearing the faces with mortar. If the wall has been adequately dampened, the surface of the wall can dry slightly just prior to pointing.

7. Just prior to pointing, pour off any water from the top of the mortar, saving for possible reuse. Mix or "knock-up" the Pointing Mortar in a bucket with a drill and a mixing attachment, using a mixer of the type pictured below.

This "knocking-up" process is to energize the mortar and not to mix the ingredients together. You can also mix small amounts of the bucket to make mixing easier.

Mix the mortar for approx. 3-5 minutes at medium speed for best workability.



With mixing, the goal is to use the mortar as dry as possible. Excess water leads to shrinkage as the material dries out. Mortar that is too wet must be compacted in lifts (layers) while it is drying to ensure proper adhesion and carbonation. Using the mortar with a very stiff consistency lessens the need to compress it in the wall, makes it less messy to work with, and keeps wall faces cleaner.

Using a mason's trowel, take a baseball size amount from the bucket and tap the bottom of the trowel once or twice on something solid. Turn the trowel upside down. The mortar should stick to the trowel. Watch the video on the website called: "How to Knock up Lime Putty Mortar"

8. Transfer the mixed mortar to a mortar pan at a comfortable working height near the area to be pointed. Keep working the mortar occasionally while pointing to keep the workability high. If mortar becomes dry or stiff, return it to the bucket and drill mix for a few minutes, or work it vigorously in the pan with a trowel. Slamming it down over and over, or hitting it with a 2x4 cutoff will accomplish the same thing. Masons used to call this process "knocking it up."

9. Using a hawk (or trowel) and a stiff, flat-iron pointing tool, place the mortar into the stone or brick joints. **Use a lot of pressure** to compress it against the back of the joint filling the joint full. Try to push the mortar without pulling the iron across it.

10. For **Fine Sand Butter Joint Mortar** a syringe may be used for ease of installation. This mortar can be diluted with clean water until it's able to be pulled thru the syringe. Apply "extra" mortar to the surface of the joint because as the excess water evaporates the fine sand mortar will shrink back. The excess mortar must be compressed to compact any shrinkage cracks as it dries using a plexiglass slicker. Care must be taken to ensure the joint is totally filled.

11. Once the joints have been filled, let them sit until the surface has dried slightly. This should not be less than 2 hours if the wall was adequately dampened and protected.

12. Once the surface has begun to stiffen, scrape the surface of the joints slightly to take them back to the desired finish level. Compact the joints by tapping a strip or block of wood held against the joint with a hammer.

13. Finish the joints before they get completely hard with a brush, completely cleaning the surfaces of the masonry units at the same time. Different kinds and textures of brushes can be used for achieving different finishes. Slicking the surface significantly slows the carbonation process but can provide long term durability.

14. Protect your installation from flash-drying and freezing. Don't leave the new pointing without checking it every couple hours. Continue monitoring moisture levels in the masonry for the next 7 days. Winds can start and the sun moves. Remember, the amount of time it takes to cure will be variable, depending upon the thickness of the installation and the environmental conditions. Cover and heat to keep it from freezing, but uncover when temperatures rise above 40 deg. F.

15. Keep the installation misted, protected, and damp for about 48 hours. It should be allowed to dry slowly over 48 hours. After this, a daily misting for 7 days is in order if the area is in direct sunlight, or in an area exposed to heat and wind. If the pointing is protected by shade, no misting is usually necessary after the first 48 hours.

16. Do not apply sealers or waterproofing chemicals of any kind. Do not use any conventional paints or stains, as all of these restrict the movement of moisture through the masonry. Breathability is critical because moisture needs to escape, and Lancaster Lime Works Natural Lime Products allow fast evaporation of moisture from masonry, keeping the masonry drier with less chance for mold, mildew, and wood rot on the interior.

17. Use only white vinegar to clean the bricks. Use it sparingly, and try not to apply vinegar to the joints themselves. **Do not use muriatic acids or other conventional masonry cleaners.** Acids react with the lime and create salts, which are then absorbed by the masonry. This can result in efflorescence and other problems. Rinse vinegar thoroughly from the wall after cleaning bricks.