Mixing Limestrong Build™ Plaster

OF THE THREE KEY components of a successful lime plaster render—mixing, application, curing—getting the mix consistently right not only contributes to an enduring and functional plaster finish, but also affects the workability of the mud on the wall and the effective flow of the entire application process. It all kicks off with the preparation.

SOURCE THE SAND

Before mixing Limestrong Build™ BINDER, acquire a stockpile of the right sand,[XRI] Limestrong Build (LSB) Binder is, as the name indicates, only the binder portion of the plaster mix. The sand (aggregate) is to be sourced locally. Purchasing the binder only provides significant savings in shipping costs, as LSB Binder is used for both the thick first (scratch) and the second (leveling or brown) coats. For instruction on choosing the right kind and size/grade blend of sand for use in lime plaster, please carefully read our Sourcing Sand publication.

Our lime plaster finish-coat product, on the other hand, is a complete mix: just add water. Limestrong Build™ FINISH plasters are used as the final coat of a three-coat plaster process and can be finished to a variety of textures. Instructions for mixing Limestrong Build Finish are included in this document following the instructions for Limestrong Build Binder.

GATHER THE TOOLS AND EQUIPMENT[XR2]

Acquire, at the minimum, the following: a mortar mixer (not a cement mixer), a couple of square-point shovels, a contractor’s wheelbarrow (or two), a source of clean water, a one-gallon water measuring bucket, several five-gallon buckets, a hawk and a trowel, mud board and stand, and a sand pile. See our Tools and Equipment publication for complete and detailed information on tool and equipment selection.

POSITIONING. Position the mixer next to the sand stock pile so one can move sand from pile to mixer efficiently. The water barrel (or hose) should be positioned nearby as well. The palleted bags of LSB Binder should be nearby, with a clear path to grab the bag and lift it up onto the mixer deck. The LSB bags should be off the ground and covered to protect them from moisture—ground moisture, dew and rain, and even over spray from hose-cleaning the mixer. Ensure that you have easy and unobstructed access to and from the front of the mixer for the wheelbarrow. A disposal bin should also be positioned nearby to take the empty binder bags and keep them out of the way.
DOUBLE CHECK THE PREPARATIONS

Before you start making mud (mixed plaster), it’s a good idea to do a final check to ensure you’re properly prepared to begin applying plaster.

**SUBSTRATE PREPARATION.** Fix any poorly prepared or missed areas before you trowel on the wet mud. Poor workmanship is not improved by three coats of plaster. If you’re spray applying, verify that all areas not getting plaster are both adequately and securely masked and shielded. On frame construction with wood sheathing, lath must be secured properly. Water-resistant barriers (WRBs) must be in place and sealed. All surfaces need to have been set up to allow drainage behind the plaster and egress (weep) below. Are the windows and other wall penetrations properly sealed and flashed and free of cuts, tears, or holes? Is there anywhere that the plaster would come in contact with the ground or final backfill? And so on. See our Substrate-Specific Application Guide Series for more instruction on this important step.

**REQUIRED INSPECTIONS.** Per local code, have you had (and passed) city, country or state inspections required up to this point? For example, most codes require an inspection of the lath and (if applicable) WRB installation before plaster is applied.

**PLAN OF ATTACK.** Think through it—how, when, and in what wall/surface order will you approach the application?

Consider the climate and season, and in particular, the expected temperatures, wind speed and direction, shade coverage, and so on. For example, on a hot day with intense direct sun, begin work in the morning shade on the west walls, then move to the north wall, then around to the east walls in the afternoon. That way you avoid the direct heat of the sun—good for both the applicators and the early stages of the plaster cure—and avoid skinning (prematurely drying out) the surface.

Do you have enough help? For example, if spray applying, you’ll need more hands on the job to keep up with the increased speed of application, the mud-mixing demands, and weather/climate-dicted frequency of the moist-curing passes.

Is the mix operator trained and had experience mixing at least a test batch? Does he or she know what correctly-mixed, ready-to-apply mud looks like? It is important that the ingredients are added in the right amounts and in the right order, batch after batch. It’s equally important that the mix operator also recognizes when something about the mud looks off and how to correct it—well before a bad batch goes on the wall.

**MIXING LIMESTRONG BUILD BINDER**

Job-sized amounts of the LSB base scratch and leveling/brown coats (made from LSB Binder and sand) are best mixed using a mechanical mixer. Mortar mixers can be rented from most equipment rental operations[1]. Unless you’re planning on spraying the plaster and running a big crew, you won’t need a big mixer. A six or seven cubic-foot mixer producing a single wheelbarrow or two of mud per batch is ideal. Note that neither the mixer nor the wheelbarrow are to be filled to capacity.

**OPERATING THE MIXER.** You will not be filling the mixer all the way up—the mixer is designed to produce optimal mix results when filled with just enough mud to cover the horizontal shaft turning the mixing blades, so, just over half full[2]. The mixer operator needs protection from dust and splatters—gloves, a dust mask, and eye protection. Protect the skin on arms and legs by wearing long-sleeved shirts and long pants.

**THE RIGHT ORDER.** Follow these steps in step order:

1) With the mixer running, two-thirds to three-quarters of the total water needed is added to the mixer.

2) Then half the sand is added.

3) If mixing a colored finish coat, the powdered pigment should be added to the churning mixture next. The sand will work as a grinding agent to break up pigment clumps and fully disperse them in the plaster, resulting in consistent colorization within a batch and from batch to batch. Any other admixtures or fibers[3] would be added at this point as well, for the same reason.

**FOOTNOTES** [0]

[1] Refer to the LSB Publication: Plaster Tools and Equipment—Equipment, for information on choosing the right mixer.

[2] If you fill a mortar mixer chock-full, the mixing action will be inefficient and will result in less workability and poor long-term quality. Ignore the manufacturer’s starburst-marketing claims of how many bags the mixer can swallow—you’re most concerned with efficient and effective mixing. Figure out how much material the mixer will take to reach the point where the main mixing arm is barely mud-covered while in operation, then stick to batching at that amount.

[3] Use fine-diameter “stealth” multifilament polypropylene fibers at 1/2 to 3/4-inch in length at the most (longer fibers tend to nest-up during mixing). Follow fiber manufacturer’s directions for dosage rate and use.
GATHER THE TOOLS

Effective flow of the entire application process. It all kicks off with the preparation, mixing, and cure—getting the mix consistently right not only contributes to an enduring and appealing finish. Of the three key components of a successful lime plaster render—mixing, application, and curing—a disposal bin should also be positioned nearby to take the empty binder bags and a clean water, a one-gallon water measuring bucket, several five-gallon buckets, and a wheelchair. Think through it—how, when, and in what wall/surface order will you approach the application? Fix any poorly prepared or missed areas before you trowel on the wet mud. Poor workmanship is a no-no! You will not be filling the mixer all the way up—the mixer is designed to produce optimal mix results, so the amount of water needed might change too, which is why the mixer needs to be monitored. Keeping the mixer dry will help prevent mud from sticking, and too much water can lead to a mix that is too wet, which can affect the final result. On a hot day, when the sand is moist, the sand needs to be mixed by hand. A hand-mixing method can be used to achieve a consistent mix. Alternatively, the counted-shovel method can be used. It’s a bit tougher to be consistent batch to batch as the shovelfuls need to be counted and the shovel-loads need to be kept roughly the same size. It takes a bit of diligent care on the part of the mix operator to pull it off. To determine number of shovelfuls needed, first shovel-fill two five-gallon buckets—not heaping, not-quite full (most five-gallon buckets will hold 5.5 gallons of sand when completely full and level)—endeavoring to keep the rounded shovel loads looking the same each time. Count the number of shovelfuls needed to fill both buckets and note the count.

LOADING SAND IN THE MIXER. Getting the right amount of sand in the mixer, batch after batch, can be accomplished a couple of ways. The most consistently accurate way is to use a bucket. A five-gallon (5G) bucket of plaster sand weighs 60 to 70 lbs., depending on moisture content of the sand pile, so the mixer operator may elect to use/lift a smaller bucket or only fill the 5G bucket half full.

Alternatively, the counted-shovelful method can be used. It’s a bit tougher to be consistent batch to batch as the shovelfuls need to be counted and the shovel-loads need to be kept roughly the same size. It takes a bit of diligent care on the part of the mix operator to pull it off. To determine number of shovelfuls needed, first shovel-fill two five-gallon buckets—not heaping, not-quite full (most five-gallon buckets will hold 5.5 gallons of sand when completely full and level)—endeavoring to keep the rounded shovel loads looking the same each time. Count the number of shovelfuls needed to fill both buckets and note the count.

ADDING WATER. Because water content (dampness) of sand varies widely, there is no hard number for the water volume ratios—you will need to work up to it. Start with part of the estimated total water needed and work the batch up to ideal consistency by feeding in the remaining water as needed. As you work through the mix-rest-remix process, add additional water as needed. Be sure to track and note the total water used to get the mud right.

If it tests a bit stiff, add a bit more water and mix for another full minute, then stop the mixer and test again. Once you’ve achieved the ideal mud, look at it closely, memorize how it looks when it’s churning in the mixer and sitting on a trowel. Make a note of how much water was used total. For the next batch, add most of that total (90%) to the mixer to begin with. Keep in mind that weather conditions—heat, wind, humidity, direct sun/shade on sand pile—can change throughout the day (or day to day), so the amount of water needed might change too, which is why the mixer operator must learn to mix by the “look” of the finished plaster instead of relying solely on fixed-amount formulas. With experience, the mixer operator can occasionally use a hose to jet-wash the binder and sand that is stuck to the insides of the mixer tub back into the batch as the mud is brought up to proper consistency.

VOLUME RATIOS

RICH SCRATCH COAT [1:1]

1-part LSB Binder to 1-part Plaster Sand

EXAMPLE: 2 five-gallon buckets LSB Binder (one 50 lb. bag) : 2 five-gallon buckets of sand. Start with 3 gallons of water; add more water as necessary to bring up to proper working consistency.

STANDARD SCRATCH COAT [1:1.5-2]

1-part LSB Binder to 1.5 (up to 2) parts Plaster Sand

EXAMPLE: 2 five-gallon buckets LSB Binder (one 50 lb. bag) : 3 or 4 five-gallon buckets of sand. Start with 4 gallons of water; add more as necessary to bring up to proper working consistency.

LEVELING (BROWN) COAT [1:2–2.5]

1-part LSB Binder to 2 (up to 2.5) parts Plaster Sand

EXAMPLE: 2 five-gallon buckets LSB Binder (one 50 lb. bag) : 4 or 5 five-gallon buckets of sand. Start with 5 gallons of water; add more water as necessary to bring up to proper working consistency.

FINISH COAT

LSB BINDER: 1-part LSB Binder to 1/2 (up to 1) part Fine Finish Sand

LSB FINISH: 1 bag (32 lbs.) of Limestrong Build FINISH (contains sand/aggregate) + 2.3 gallons of water.

WEIGHT-TO-VOLUME BASICS

• A single bag of LSB Binder, by volume, is approximately ten (10) gallons and weighs 50 lbs.
• A five-gallon (5G) bucket of plaster sand (not quite full) weighs 60–70 lbs. (depending on moisture content of sand).
• A five-gallon bucket (not quite full) of water weighs around 40 lbs.

EXAMPLE: Weight Ratio for Basic Scratch Coat: 50 lbs. (1 bag) Binder (two 5G buckets) + 250 lbs. damp plaster sand (four 5G buckets) + 4 gallons of water.
MEASUREMENTS AND QUANTITY RATIOS. Plaster is typically proportioned and mixed by volume. Mix ratios of LSB Binder vary, depending on coat (see table, right).

The SCRATCH COAT is the first coat and must bond securely with the substrate. It is mixed rich and applied just thick enough to cover the surface and provide enough depth in which to scratch a mechanical bond surface to give tooth for the next coat.

The LEVELING (BROWN) COAT, serves to bring the surface up to a more uniform level and create the final shape and look of the plastered walls.

The FINISH COAT is applied thin and used as the color coat (if any) and worked to provide the desired finish texture.

**BATCHING EXAMPLE.** Mixing a batch of standard scratch-coat mortar in a 6 cubic-foot mixer calls for two (2) bags of LSB Binder and up to eight (8) five-gallon buckets of sand. Initial calculated water volume is 8 gallons. With mixer running, add most of the water, then half the sand, then the binder, then the rest of the sand. As the mud mixes, pay attention to the water demands and add more water, a little at a time, to get the right mud-moisture content. Allow to mix for five minutes. Once the consistency is right and passes the trowel tests (see below) make a note of how much total water was required for each mix ratio type (rich-scratch, standard-scratch, leveling, and finish).

**SCREENING FINISH SAND.** If you chose to use LSB Binder (instead of LSB Finish) for the final finish coat, you’ll want to screen off the larger particles in the stockpile. Unfortunately, damp sand does not screen particularly well. Spread out what’s left of your sand pile to expose more surface area to the sun to dry it out. Build a frame and stretch it with common window screen material. Shovel sand from the dried-out stockpile onto the screen, shake the screen back and forth to work the finer sand particles through, then discard the large particles that remain on the screen. What piles up below the screen will serve as the fine-finish-sand stockpile.

**BAGGED SAND.** There are also various types of fine sands that can be purchased in a bag—silica sand, pumice sand, limestone sand and masons sand. Keep in mind that the grade/particle-size blend of the sand is still very important—some bagged sands may contain only mono-sized particles.

**MIX TIMES.** Mix times must be monitored closely by the mixer operator. Lime plaster mixing process—mix-rest-remix—should be NO LESS than seven minutes. Longer is better (10 to 12 minutes), as longer mix times make lime plaster more workable (fatter) and insure full hydration. Under-mixed batches will lack proper hydration of the binder, which results in a weak plaster.

**HOLD TIMES AND REWORKING.** Due to the absence of Portland cement, mixed Limestrong Build plaster mud can be stored (tightly covered and kept cool), and reuse for 3 to 5 days. Retemper as necessary to return to a working consistency.

**TESTING.** The right consistency (and thus the right amount of water) is determined by testing. Note that after the initial testing is done and the ideal mud fluidity is determined, the operator makes a note of the final amount of water that was required and how the mud looks when correctly mixed. From then on, provided all things remain the same in terms of ingredient amounts, sand pile dampness, ambient temperature, additional testing is not needed—at least beyond the eye test.

Testing is done by stopping the mixer (never put your hand or a scoop or anything else in the mixer when the blades are turning), taking a sample and putting it on a horizontally-held hawk or trowel. (Alternatively, you can rotate the tub and dump a small sample out.) The mud should slump to about 2-inches high. If the mud is running off the trowel, it’s too wet; if it forms cracks, it’s too dry. If the mud stays stuck to the trowel when held horizontal and through up to 30-degrees of horizontal, but slides off when tipped at 45-degrees or more, the mix is right. If the mud does not release and slide off at 45-degrees, it probably doesn’t have as much water as it needs. If the mud slides off as soon as you tip the trowel, it’s too wet. Return the sample to the mixer and adjust as necessary, tracking the amount of water added. Mix for an additional minute each time water is added. Then retest. If the initial mix tests too wet, you might be able to save the batch by adding additional binder and sand (at ratio), but know you can’t

**FOOTNOTES [0]**

[4] Use of Limestrong Build Finish, an all-in-one product, avoids having to buy finer sand or screen-off the course sand particles from your stockpile to obtain the finer-grade range of sand.

[5] Retempering means to take plaster mud that has stiffened and work it back to a creamy, usable consistency by stirring/mixing it either with a trowel on the mud board, with a drill and mixing-paddle attachment in a mud tub, or returning the mud to the mixer. Often, it is necessary to add a little water as well. Lime plaster can be retempered for up to 5 days without adversely affecting final bond strength.
use that batch to determine the ideal amount of water. Mix a new batch using less water to start with, then add water as necessary to come up to the proper consistency. Make a note of the final water requirement.

Understand that there are circumstances when a slightly stiffer or wetter mix is needed. For example, an especially hot day with a stiff, moisture-sucking breeze might call for a juicier mixture to offset the elements working to dry out the mud from the second it’s poured from the mixer. Adding more water provides more time to get it on the wall, troweled to coat height and misted before too-soon surface drying becomes a problem—impactting both ease of finish and cure quality. See the LSB Troubleshooting Guide publication for more information.

EYE TEST. When you’ve mixed the perfect batch of lime plaster, look into the mixer and note how the mud behaves as it turns over with each rotation. Memorize how that looks. When you can mix plaster mud by eye, you’ll not need to run tip-tests.

DISCHARGE. Dump the mud into a wheelbarrow by unlocking and rotating the tub, leaving the mixer running and allowing the paddles to sweep the mud out. Return the mixer tub to the upright and locked position. Add the now-known initial amount of water to the mixer in anticipation of the next batch.

INSTRUCTIONS FOR MIXING LIMESTRONG BUILD FINISH PLASTERS

Limestrong Build Finish plasters come ready to mix: just add water. LSB Finish is packaged in 32 lb. bags—enough to mix with 2 gallons of water in a common five-gallon bucket to make one small batch. Multiple bags of LSB Finish can also be mixed in a mortar mixer. Six or eight bags in a 6-cubic-foot mortar mixer should provide a full mixer-sized batch.

WATER. For each bag of mix, you will need 2 gallons of clean water. Add the water first (holding back a quart if adding a liquid colorant, per instructions below). KEY: when working with fine-grained aggregates, like those in Limestrong Build Finish plasters, use just enough water to reach workability. Fine-grained and pumice-aggregate plasters absorb a lot of water, and too much water in the finish-coat mud could result in too much shrinkage.

COLORANT. By virtue of the white lime and near-white aggregate used, LSB Finish plasters are naturally off-white when dry. Any universal tint will work as a colorant, especially quality dry-powder pigments like those used in the Limestrong Color System.\(^8\)

CONSISTENCY in ingredient amounts, add-order, and mixing times at each stage is critical to achieve consistent color batch to batch and, ultimately, on the wall. One of the advantages of mixing bucket-sized batches is the ability to more carefully control the consistency of the color from batch to batch. LSB Finish comes packaged for bucket-batches: one bag of LSB Finish makes one bucket-batch of finish plaster.

MIXING LSB FINISH PLASTERS: MIXER-SIZED BATCH. With the mixer running and the paddles turning:

1) Add the water.
2) Add colorant (see below), if applicable.
3) Break half the total bags needed on the mixer deck and into the mixer tub. Mix for two (2) minutes. Do NOT attempt to scrape the sides of the mixer tub with paddles turning.
4) Add the remaining bags of plaster to the mixer. Add a bit more water, as necessary, to bring the mud to the right consistency.
5) Allow to rest for five minutes, then remix for two more minutes, adding a bit more water, if necessary, to reach ideal workability. On the first batch, run a trowel test, then memorize the look, feel, and color depth of a correctly-mixed batch.

MIXING LSB FINISH PLASTERS: BUCKET BATCH:

1) Add the water.
2) Add colorant (see below), if applicable.
3) Pour one-third to one-half the bag of Limestrong Build Finish into the water in the bucket. Mix well with the drill/paddle attachment for two (2) minutes. Scrape any unmixed plaster that sticks to the side of the bucket into the wet mix.
4) Add the remaining plaster to the bucket. Mix thoroughly and scrape sides of bucket often to ensure dry ingredients (and pigment, if used) are fully incorporated.
5) Allow to rest for five minutes, then remix for two more minutes, adding a bit more water, if necessary, to reach ideal workability. On the first batch, run a trowel test, then memorize the look, feel, and color depth of a correctly-mixed batch.
ADDING COLOR: USING LIQUID COLORANT (Step 2). Do not shake tint container. Carefully measure pigment. Pour entire measured contents of the liquid pigment container into the mix water. Rinse the container twice with a quart of saved mix water and use a small paint brush to clean all of the tint pigment from the sides and bottom of the container to ensure all the tint is used. With all the tint in the water, mix to fully disperse, as some of the tint may have settled to the bottom. Proceed with steps three through five as per previous instruction.

Mix the mud until colorant is fully dispersed. Make a note of the mix times you settle on as adequate—both to fully disperse the colorant into the mix water and to thoroughly blend the color into the mud. Then repeat those mix-rest-remix times consistently from batch to batch.

ADDING COLOR: USING POWDERED COLORANT (Step 2). Add weighed/measured pigment powder to pre-measured mix water while agitating water slowly to avoid settling. Tap to knock free any pigment clinging to sides of container[7]. Mix for 30 seconds to one minute, making sure colorant is completely dissolved in the water—undissolved clumps of pigment will cause streaking when applied to the wall. Add plaster immediately.

Mix thoroughly (at least five minutes) to completely disperse pigment and fatten the lime plaster to optimal workability. Allow to rest for five minutes, the remix for two more minutes. Increase the mix times as necessary. Make a note of the mix times you settle on as adequate—both to fully disperse the colorant into the mix water and to thoroughly blend the color into the mud. Then repeat those mix times consistently from batch to batch.

**KEEP TOOLS AND EQUIPMENT CLEAN**

Cleaning tools and equipment often and in a timely manner prevents grief later. It’s much easier to remove wet and damp mud from tools and mixer rather than trying to chip and knock it off when it is dry and hard. It’s a real exercise in frustration to have little chunks and crumbs of dried plaster fouling your fresh mud. A good practice to follow: thoroughly clean tools and the mixer right before breaking for lunch, then again at the end of the work day.

**SAFE USE PRECAUTIONS**

Limestrong Build™ plasters contain hydrated (slaked) lime, which (because of a high pH) is somewhat caustic. Breathing the powder dust can also cause respiratory irritation. BE SMART. Protect yourself[8]. In all situations, if irritation develops, seek medical attention. Please read our Safe Use Precautions and Treatments publication for information on protecting and treating skin, eyes, and breathing function.

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**FOOTNOTES [0]**

[6] Another option to coloring or tinting the finish coat is to use a limewash. See the LSB Publication: Coloring Plaster with Limewash for more info on limewashes.

[7] Limestrong Color System packs can be purchased pre-measured for a single bucket batch, making it easier to be consistent on colorant amount.

**CROSS REFERENCES [XR]**

[XR] LSB Publications: Safe Use Precautions and Treatments; Limestrong Build Safety Data Sheet (SDS).