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PLASTER AND STUCCO

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General

Plaster is one of the most ancient of all building materials. It all started with primitive man plastering mud over a framework of sticks, branches and reeds to enclose a protective structure.

The Pharaohs of Egypt used plaster surfaces in their palaces. The pyramids contain plasterwork which exists to do this day, 4000 years later. Research has also indicated that the principal tools of the plasterer of ancient Egypt were virtually identical to those in use today. It is also known that Egyptian plaster was produced with calcined gypsum – much like the plaster of Paris of today.

The Greeks put plaster to work beginning in 500 B.C. The word "plaster" comes from the Greek language meaning "to daub on." Plaster was highly regarded as a fire protection material during 13th century London.

The Renaissance period of the 14th through the 16th centuries developed the baroque masses of carved figures, foliage and flowers covering both ceilings and walls. During the 16th century the use of plaster was developed to a height unequaled in history. This was followed with the Rococco display of overpowering ornamentation which reached its greater development in France during the 18th century.

From the Renaissance up to the middle of the 19th century the plasterer used lime and sand for the basic work of covering walls and ceilings. This plaster mix was slow drying, often taking two weeks to set and harden even under favorable conditions. Gypsum plaster used at that time set much faster, but due to the high cost of gypsum, it was reserved for ornamental work. Since the beginning of the 20th century, gypsum and its derivative plaster of Paris have gradually replaced lime as the binding agent for sand.

A number of other developments have contributed to changes in the centuries-old methods of plastering. Portland cement was developed in England about 1825 but was not used in this country until later in the century. Today Portland cement is almost exclusively used as the cementitious materials in stucco (our exterior plaster). Keane's cement was also developed in England shortly after Portland cement. Keane's cement plaster is a slow setting, extremely hard plaster. The use of metal lath and gypsum lath started to surface prior to the turn of the 19th century. The development of new materials, lathing and mechanically-powered equipment has brought plaster and its use to the present highly-developed state.

Plastering Bases

A plaster job is neither better nor stronger than its weakest component, and, since the base to which the plaster is applied is one of the essential components, the base must be strong, clean and stable.

Generally, there are two classes of bases-masonry bases (brick, block, stone, etc.) and lathing bases (gypsum lath, expanded metal lath, wood lath, etc.). In use of any of the bases, bond is one of the

most essential requirements for successful plaster. Bond is obtained through mechanical bond, as on lath, or adhesion caused by the crystalline structure in the setting action of the plaster.

Masonry bases must be solid, clean and void of foreign substances to obtain proper adhesion. Lath of all types must be thoroughly fastened to the structural substrate.

Plaster Mixes

Generally there are two standard mixes of sand and plaster, namely 2:1 and 3:1. The ratios express weight of sand to weight of plaster.

The 2:1 mix should be used for scratch coats over all lath and for the brown coats in two coat plastering operations.

The 3:1 mix should be used for scratch and brown coats over masonry and for brown coats in three-coat plastering.

Quality and cleanliness of sand are important.

Simplicity in obtaining the correct proportions, by weight, of each ingredient is a must at the project site. The sand shovel is the mixer's best friend. A number 2 sand shovel will hold approximately fifteen pounds of moist sand. Thus, for a 2:1 mix, each one hundred pound bag of plaster will require 200 pounds of sand or 14 shovels of sand.

In designing mixes it should be remembered that a plaster job is no better in strength and lasting qualities than the strength and quality of the base, or brown and scratch coats. Over sanding should be avoided. Maintaining proper thicknesses is imperative. It is advisable to include a waterproofing material in stucco mixes – many premixed cements include this material.

Basically, there are three cementitious materials used in mixing with sand and water to produce plaster.

1. Portland cement is a carefully proportioned mixture of clay and limestone materials ground fine.
2. Lime is from pure calcium limestone or magnesium limestone heated or "burned" in a kiln at a very high temperature.
3. Gypsum is produced by calcining, a heating process of gypsum rock. In powdered form it is known as "plaster of Paris", so named because of its early production in Paris, which is built over vast beds of gypsum.

In earlier times, lime mixed with sand and some roughage such as animal hair was the most commonly used plaster for base coats, but since before the turn of the 19th century, gypsum plaster has become more and more the most used cementitious material. Lime mixes dry slowly. Gypsum mixes dry rapidly.

Plaster and Stucco Uses

Plaster and stucco may serve many purposes other than providing a plastic material for smooth surfaces, or moulded shapes. Plaster has always been recognized for its sanitary qualities. Its value as a fire retardant was so important to fire plagued London during the 14th century that it was made a requirement for all buildings to have plastered walls.

Stucco is a handy tool for use in putting strength back into deteriorated brick masonry. As is quite common, lime/sand mortar in brick masonry deteriorates over the years, particularly when exposed to extremes in weather and moisture. Low quantity and quality of lime in the mix contributes to the

mortar failure. In walls such as this, the loose, failed mortar may be raked out and cleaned as best as possible. Over the cleaned surface, a coat of bonding agent is applied and a layer of self-furring reinforcing mesh is securely nailed to the masonry.

Stucco is finally applied in a three coat application. When the wall is in a very bad condition and the depth of mortar decay is deep, it is wise to carry out this operation in small areas at one time. This procedure was extremely helpful in re-solidifying the brick steeple of St. John's Episcopal Church in Montgomery where sound stucco existed on the exterior but the unstuccoed interior masonry construction was deteriorated to the point where brick were falling out on a regular basis. A similar operation was carried out on the exterior walls of the Alabama State Capitol during exterior restoration.

Plaster and Stucco Problems

Three main difficulties plague the use of plaster and stucco.

1. Weather: Newly applied plaster or stucco must cure properly. Very dry weather causes the plaster or stucco to dry too quickly. Very wet weather causes the plaster or stucco to "rot." Freezing prevents proper curing or setting. During hot weather, curing stucco must be "fogged" frequently to prevent fast drying.
2. Proportioning and Mixing: Properly proportioned and mixed plaster and stucco with proper materials is vital for a quality product. Oversanding and excessive retarding materials should be avoided. Excessive coloring materials added to stucco weaken the finished product.
3. Human Element: Personal error, carelessness, and misjudgment may destroy the excellence demanded in all the operations involved in producing a quality product.

Repair

Restoring damaged or cracked plaster on the interior of a house must be approached with care and reasoning. It is common for home owners to take one look at what appears to be an unsalvageable wall surface and opt to rip the whole thing out and replace plaster with gypsum board. Since gyp board lacks the texture of a plaster wall, most people want to avoid its use.

Most plaster walls can be saved. If the majority of the wall surface is sound and in good condition, it should be retained.

Preparation of plaster surfaces is of supreme important in repair. After removal of old wall paper or other coverings, all surfaces should be checked for material quality, soundness and adhesion to the substrate. Plaster which has pulled away from wood lath or brick should be removed and replaced from scratch.

In many cases, the remaining good plaster is very rough due to old wall paper, cracks, and other damage and, if so, it is best to put another finish coat of plaster over the whole wall after cracks and other surface repairs are made.

To prepare the surface for a new finish coat of plaster, depending on the labor cost situation, as much of the original finish coat should be removed as possible. However, by scarifying all surfaces thoroughly the scratched, cut or chipped surfaces can provide a good surface to which the finish coat can adhere. Prior to application of the plaster, surfaces must be dry and clean. It is usually best to apply a coat of bonding agent to the roughened surfaces.

It is important that all sources of moisture be removed. Sealants around windows and doors are a must. Plumbing and roof leaks are constant threats to sound plaster. Many old buildings with brick footings

encounter the problem of moisture seeping up from the ground into the walls. This is an expensive problem to resolve, usually requiring underpinning the old footings with concrete.

As is indicated in the references, *the Old House Journal* offers many solutions to all the varied problems of restoring plaster.

Recreation of plaster mouldings, stuccoed columns, lunettes, castings, modeling and other forms of ornamental plaster, is another story in itself. It involves templates and molds, both rigid and hinged, gig sticks, bench molds and all sorts of gadgets and tools used to develop the plasticity of plaster and stucco into architectural shapes. Not enough space is allowed here to get into this area of the art of plastering, but the book "Plastering Skills," mentioned elsewhere, describes these operations reasonably well. We also have a series of slides which demonstrates the process of "running" cornices and miscellaneous mouldings with fixed templates and fluted columns, both straight and with entasis, using a hinged template.

Plaster and Stucco References

The Old House Journal:

June 1975	Patching plaster-workability, shrink reduction and finish coat mix.
May 1975	Gesso, (originally a mix of plaster, white lead and oil) on wood mouldings simulates plaster.
Sept. 1975	Recreated plaster on plywood using gyp board joint compound (spackling) mixed thick.
Mar. 1975	Portland cement use-unyielding-new materials mixed with old-old not as strong – new stress patterns – correcting cracks sometimes causes double new ones – exterior weathering – new hard materials weather slower – require long term solutions – not an easy home project.
Mar. 1975	Formula to simulate old lime sand stucco and mortar. Mix: 1 part Portland cement by volume, 3 parts lime by volume. Then add 3-5 parts sand by volume, to 1 part of the cement-lime mix.
July 1977	This issue gives good details on crack repair – illustrations, etc. Plaster cracks – replace everything or use a mending system that has some "Give" t it. (Example: sheetrock joint compound such as "Durabond U.S. Gypsum Wall Board Compound" with tape or cloth reinforcing. (cloth best) Problem cracks – use a commercial patch system for more flexibility ("Krack-Kote mfg. By Tuff-Kote Co. Woodstock, Ill.; "Tuff-Patch", a vinyl compound and will move) available at large paint supply stores. Cracks between wood trim and plaster use acrylic latex caulking (inexpensive and easy to use). If wall is too cracked up – replace all plaster or canvas.
June 1977	Using join compound ("Wall Board Compound." "Taping Cement", not spackle).
Nov. 1978	Simulating old plaster using thinned drywall tape compound over sheetrock.
June 1977	Loose plaster on walls – remove in ceilings in small areas – fasten to structure or lath with screws and washers or "keying" in a patch well attached to lath on walls. Loose plaster in ceilings – usually should be removed.
Dec. 1978	Duplicating plaster mouldings with rubber latex moulds.
Feb. 1979	Good resume of plaster-restoring damaged plaster, plaster cracks. Removing wallpaper etc.
May 1979	Bonding agents – 1. For plaster; 2. For concrete.
July 1979	Repairing stucco. Stucco after 1870 probably Portland cement.
June 1979	Lime-Sand Stucco-"Soft" lime stucco-portland much harder. Formula on page 79. See page 78 for precautions. See page 79 for various early mixes. Also Portland cement plaster-care in application-not fast drying etc. The problem usually with stucco is not

	that the stucco is not solid but that it has become loose from its substrate (concrete, brick, lath, etc.) either by lack of bond or cracking and water freezing behind.
Oct. 1980	Pages 131-142-146. Repairs, failures, etc.
Dec. 1980	Pages 185. Filling Cracks. Also a tip. *Use plastic, flexible containers so can clean easily when plaster hardens. *Use about two teaspoons of vinegar to one quart of plaster keeps plaster a little more plastic longer.
Feb. 1981	Page 41. Quick dry patches with heat gun. Page 166. Plaster resurfacing fabric.
Oct. 1981	Page 220. Glid-wall replaster system. Stucco on stone-wet stone prior to applying stucco-also wet wood lath before stuccoing or plastering – or apply bonding agent. See May 1981, page 119.
Nov. 1983	Plaster restoration – Good Resume. Page 200.

One of the best reference books upon which we have come to rely is *Practical Plastering, Cement Finishing and Related Subjects* copyright 1937 by Byron William Dalton. With no success, an effort has been made to determine the availability of this book. The most probable source (and for sure for loan only) would be the libraries of plastering contractors who have been in business for a generation or so.

This book by Dalton tells it all: tools and equipment, geometry in plastering, development of moulds, templates, benching, materials, and on and on.

Another most useful book is *Plastering Skills* written by F. Van Den Branden and Thomas L. Hartsell and first copyrighted in 1953 and again in 1984 with the collaboration of *The Old House Journal*. Though not quite as thorough in old methods and techniques, *Plastering Skills* is every bit as full of information as Mr. Daltons' book.