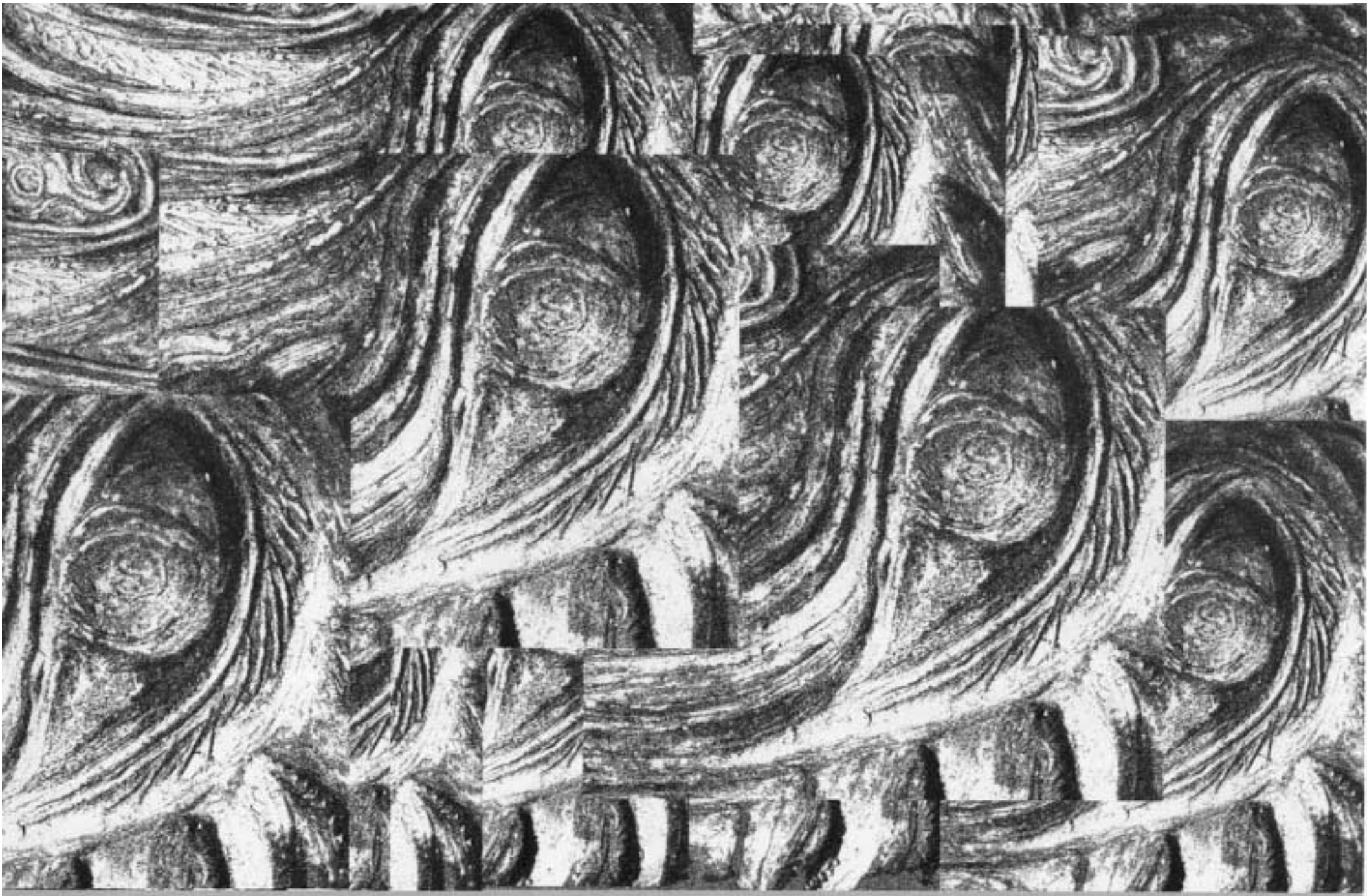
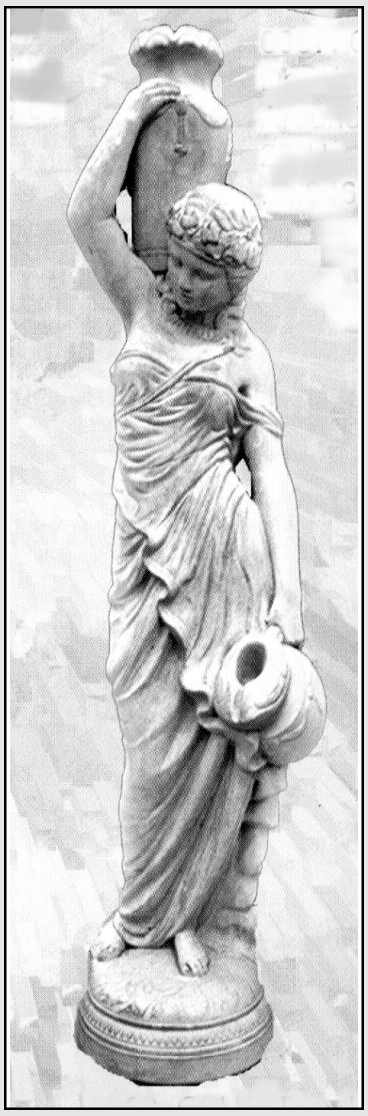


WORKING WITH PLASTER



Girl with Two Jugs
Nunnikhoven Group

The following information has been adapted from a booklet prepared by the **U.S. Gypsum Company**

U.S. GYPSUM INDUSTRIAL PLASTERS

USG Molding Plaster

This general purpose plaster reproduces intricate detail but is porous and must be carefully sealed before decorating.

USG White Art Plaster

USG White Art Plaster gives excellent detail, provides a harder surface and has lower paint absorption than molding plaster.

Industrial Plaster PC

This is a special plaster blended with polymer and synthetic fibers for producing solid or slush cast products. It provides better chip resistance and impact strength in cast items. This plaster is used by many shops for shells to support latex-type molds. Superior strength permits thinner castings.

Industrial Plaster PC-1

Formulated for manufacturing decorative brick, stone, and other deeply colored cast oobjects, this product permits blending large quantities of pigment needed to simulate natural materials.

GYPSUM CEMENTS

Gypsum cements require less water for mixing and produce casts that are less porous, easier to paint, heavier and more durable. (Since gypsum cements generate more heat while setting than standard industrial plasters, they should be used with molds of latex, hot melt, polysulfide rubber, silicone, or urethane rubber.)

HYDROCAL White Gypsum Cement

This hydrocal offers a gradual setting time and a long period of plasticity. It is recommended for both solid and hollow castings. It is especially recommended for thin pieces which require high green strength to minimize breakage during removal from an intricate latex mold.

Statuary HYDROCAL Cement

It is harder and stronger than hydrocal white. It has hardness and strength and excellent plasticity. These properties make it especially adaptable for solid or hollow art castings.

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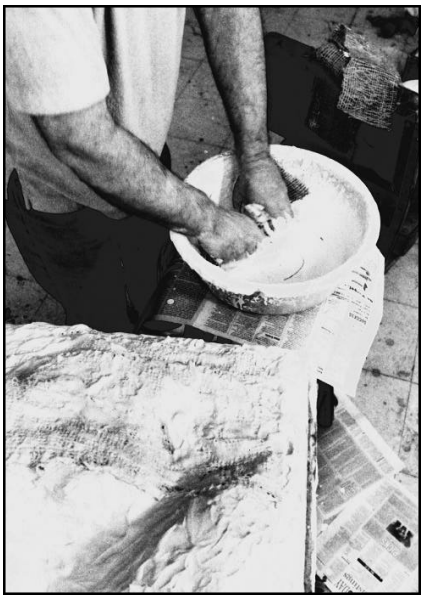
HYDRO-STONE Gypsum Cement
This is one of the hardest and strongest of all gypsum cements. When mixed properly (at 32 consistency) it is heavy and syrupy, and easily poured into a mold. It is recommended for producing high quality statuary castings that require extremely hard surfaces.

The factors that distinguish one type of industrial plaster from another include physical properties such as setting time, consistency (quantity of water required for mixing), fineness, hardness, strength, workability, and surface characteristics.

PLASTER AND WATER

An ideal plaster mix is one in which the plaster particles are completely dispersed in the water to produce a uniform, homogeneous slurry.

Water used in plaster casting should be pure. If water is drinkable, it is probably suitable for mixing plaster. Sometimes the chemicals that are suspended in the water can create unwanted reactions in the plaster. Some regional waters are unsuitable.



Water temperature variations affect setting time and mixing times. Plaster is best mixed with water between 70° F and 100° F. 100° F is optimum.

The water to plaster ratio (consistency) is the amount of water used with a definite amount of plaster. Consistency is measured by the weight of the water and the weight of the plaster, rather than the volumes. The amount of water used in a mix severely affects the strength, durability, and setting time of the plaster. Although experienced plaster users can gauge the mix by eye, it is recommended that the manufacturer's stated consistency for each plaster be carefully followed.

Each plaster particle is surrounded by air. This air is removed during soaking. Soaking allows each plaster particle to become saturated with water, allowing a smoother mix to occur. Plaster should always be added to the water, rather than the water being added to the plaster. After they have been mixed, the slurry should be allowed to disperse for a moment before it is used. A good plaster will sink slowly into the water and become almost completely wetted after three or four minutes.

Mixing the plaster slurry is a most important step in producing casts with maximum strength. Shorter mixing times will provide a longer setup time, but it is a trade-off for strength and hardness. A mixing time of about 10 minutes will prepare a batch of plaster with about five minutes of pouring time. This is the optimum ratio.

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MIXING DIRECTIONS

Sift the plaster into the water slowly and evenly. Allow the plaster to soak for two to four minutes. Then mix the plaster and the water, stirring carefully to avoid entrapping air. Mix for two to five minutes.

Mechanical mixing is superior to hand mixing. For the best results, use a high speed direct drive propeller mixer with the mixing shaft set at an angle of 15 degrees from vertical. The shaft should be about half way between the center and the side of the container, and about two inches from the bottom. The propeller rotation should force the mix downward.

Generally, only one propeller is necessary, but if it does not provide enough turbulence, two may be used.

Other tools and methods of mixing are used including three blade mixers, flat disc mixers, and continuous mixers.

Different accelerators and retarders are available to change the setting times of the plaster mix.

The setting time is the period between the mixing with water and the moment when the plaster is ready to use. Times vary. During the first portion of setting time, the plaster mix is fluid and easily poured. Later in the process, the material is in a plastic state which allows it to be shaped or applied in a manner other than pouring. Once the material has set, however, it cannot be altered. Carving, sanding, or adding more plaster can be methods of altering the surface of set plaster.

DRYING

Plaster casts must be properly dried. To obtain a usable slurry, excess amounts of water are used. (Plaster only requires about 18.6 parts of water to 100 parts of plaster.) All the excess water must be removed in the setting process. Controlled hot air can be used, or the casts can be simply set in the open air. Controlled drying is more uniform and more controllable and for that reason preferable.

While the plaster is setting, and releasing its excess water, it is also generating heat. A slight rise in the temperature of the plaster will be sensed while it is setting. The surface of the casting heats, causing the surface water to evaporate. This draws the excess water from the inside, which, in turn, evaporates. The deepest parts of the casting will be the last to dry.

Although a forced-air dryer is preferable, heated air can overdry and calcine the cast. Plaster that has calcined from excessive heat will be powdery and weak. Temperatures of

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about 110° F to 120° F are recommended. When the surface feels dry and is the same temperature as the surrounding air, the drying process is finished.

The industrial plasters, PC and PC-1, can be efficiently dried at temperatures between 125° F and 130° F. Temperatures higher than these will cause calcination.

Normally, plaster should not be stored for more than 90 days. Stock should be rotated so that earlier shipments are not left in the back of storage areas too long. Plaster should be stored in a warm and dry location away from cold or damp floors or walls.

COLOR PIGMENTS

Many additives can be used to produce colored casts. Two materials that have been used successfully are:

a. dry powder metallic oxides such as iron and chrome oxide, etc. These are usually available as additives for coloring Portland Cement.

b. predispersed pigments used for coloring latex paints. These should be first tested in small batches to determine their effect on the set plaster.

Zimmerman Lawn Ornaments
Langworthy, IA

WET

Wet colors, or dispersions of color in liquid, may easily be simpler to use than dry pigments. These colors can be added directly to the water for each mix of plaster. A small quantity of color dispersion produces a fairly deep color intensity.

Color in the plaster will not produce a uniform shade of color in the dry cast; areas of light and dark concentration appear. Also, the color in the cast may not be compatible with the surface color decoration, and also, it may bleed through unevenly.

DRY

Some dry pigments may contain chemicals that accelerate or retard setting time in the plaster. They may also cause excessive pinholing in the surface of the plaster cast. The addition of color pigments alters the composition of the plaster and impairs the physical properties of the plaster cast. An addition of only a 10% mix of color pigment can weaken the plaster by as much as 50%.

Dry colors are best handled by adding them to the water before it is mixed with the plaster. The pigment is completely dispersed into the water that is to be used. Since many pigments are not water soluble, they should be thoroughly stirred immediately before the water is used.

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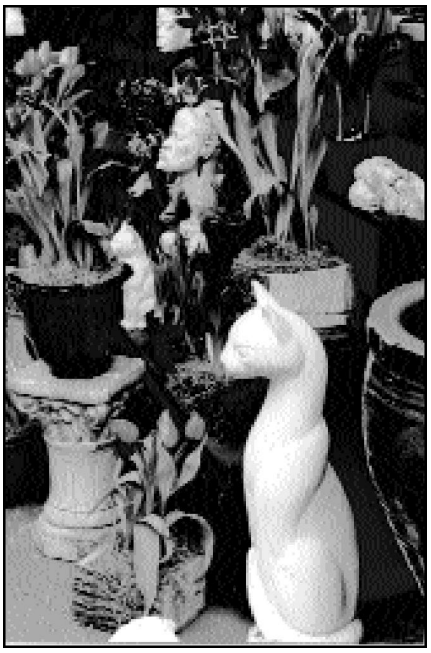
CASTING

Plaster is used for both creating molds as well as the material that is cast into the mold.

Several methods are used to form plaster.



Solid casting

The most common use is the solid poured casting. A mold is prepared, and the plaster is carefully poured into the mold until it is filled. The cast is then set to dry. The finished cast will be a solid replication of the mold.

Hollow casting

Hollow or slush casting will create a hollow finished piece. The plaster is poured into the mold, filling it to about a third. Then, the mold is swirled and rolled until the plaster adheres to the entire inside of the mold. Then, the excess plaster is poured out of the mold, potentially into another waiting mold. When the plaster has set sufficiently, while it is still wet, another layer is added repeating the same steps with the same swirling motions. The excess is poured out. This process is repeated until the hollow casting has built up a satisfying thickness along the inside walls of the mold.

Splash casting

Often used in constructing a mother mold, this method is the most direct (but the least controllable). Mix the plaster and continue until it becomes plastic rather than fluid. With your hands, or with a trowel, splash or press the plaster over the model. Build up a layer quickly by spreading the plaster into all the detail. Actual splashing will force air out of details more readily. Using the trowel, build the plaster until it is about 1/2 inch deep over the entire model. Then, to create strength in the mold, soak small strips or swatches in liquid plaster, and lay them over the casting. Progressively build them, interlacing them, until the entire mold is covered. Then smooth over those pieces with a thin layer of liquid plaster. The burlap is added to give the mold strength.

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TRIMMING AND PATCHING

After the casting is removed from the mold, there may be fins, pinholes, and rough edges that need to be filled and trimmed. Before filling pinholes, slightly enlarge them. Often bubble holes are larger inside than on the surface.

Patch plaster that is wet. Add water to the area that is going to be patched before applying the plaster patch. Rough edges and fins can be cleaned with a rasp or a knife.

There are many ways to finish plaster casts. They include painting, metallic leafing, rub-on waxing, flocking, resin coating, plastic spraying, electroplating, and staining. Accessories can also be added...wiggly eyes, ears, eyelashes, whiskers, felt, yarn, fur, glitter, and even feathers.

Finish the plaster cast and review it for any imperfections that can be repaired. Make sure that the piece is completely dried, then seal it with shellac, lacquer, or acrylic. This helps to create a uniform surface and seals the plaster against moisture.

Thin the sealer so that the cast readily absorbs the first coat. Apply an unthinned second coat after the first coat has thoroughly dried.

There are many excellent paints for finishing and decorating plaster.

However, first and foremost...
plaster must be completely dry before applying paint or paint will peel and flake.

Metal leaf or foiling

Metallic leafing is a slow process but its effects can be obtained in no other way. Basically, the plaster cast is sealed with a color similar to the metallic foil. Next, an adhesive is applied. On the adhesive, the foil is pressed with a brush until the entire area, or surface, is covered. Sometimes a stain is added over the foil and set with spray coats of clear acrylic.

Rub on wax

The colors in paste wax form are used to accentuate the piece. To use, seal the casting and base coat with paint; then rub on the wax to accent metallic or pastel areas, or completely flood a casting with wax.

Flocking

Flocking will give a piece a velvet touch or texture. Electrostatic flocking makes precise placement of acrylic fibers possible.

After the plaster is sealed, an adherent, close in color to the flocking, is brushed on. Loose acrylic fibers are placed in a plastic cylinder, and a wand is connected to a power unit. This charges the fibers, attracting them to the wet glue surface, into which they embed themselves, upright. The wand is passed over the casting until the desired density of fiber and surface color are achieved.

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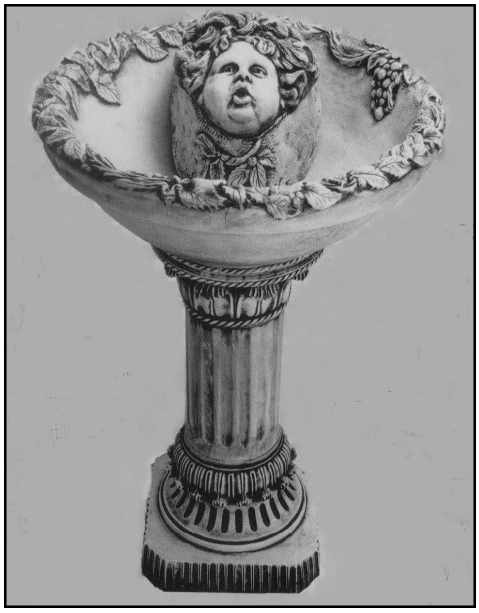
MOLD MAKING

Molds can be made from a variety of materials. Generally, they fall into two categories: rigid or flexible. Among the rigid molds, including plaster and fiberglass, there are the vacuum-formed plastic molds.

Vacuum-formed molds are used when a low cost, shallow detail, two-dimensional mold is desired. If carefully handled, they can produce up to 100 castings. These molds require a back-up shell when used in casting, which can be fabricated from either plaster or sand. Often a clean and dry sand bed is used. The mold is pressed carefully into the sand until it is completely supported, and the plaster is poured directly into the mold.



"Laura" Face withPumphouse
Nunnikhoven Group

Flexible molds may be made from gelatin, latex, cold compounds, hot melt, polysulfide, urethane elastomers, and other materials having good strength and elasticity. Flexible molds are a necessity for art work involving complicated figurines or detail.

They are expensive and they may require days, or weeks, to complete. A back-up shell (or mother mold) is almost always necessary to support their shapes while pouring.

Latex rubber has a low raw material cost, and less material is used than in other flexible substances. If cared for, latex molds can last for years and survive hundreds of castings.

The most common way to apply latex is with a brush; however, it can also be sprayed or dipped. Dipping is quicker, but only seamless (glove mold) one-piece molds can be completed in this way. Spraying is equally limited, but can be used on very large molds.

Cold molding compounds

Silicones, polysulfides, and urethanes are cold molding compounds. Each comes in different grades, strengths, hardnesses, and flexibilities. Some are more dimensionally stable than others or retain their detail and form through time and use. Cold molding compounds offer better dimensional stability and faster mold preparation than latex, and molds can be made in days rather than weeks. Cold molding compounds usually consist of two or three components that must be weighed carefully and mixed properly to insure satisfactory results. Recently, new cold molding compounds that can be mixed by volume (see RTV section of this catalog) have been developed.

Hot melts

Similar to cold molding compounds in the style of mold that they can produce, hot melt molds differ in that the materials must be heated to a liquid before pouring.

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Hot melt molds are used in very few operations.

PROBLEMS

PROBLEMS

Either too quick or too slow a setup of the plaster slurry is probably the result of contamination. The cause is often dirty mixing equipment or contaminated water.

Plaster that has become lumpy has been exposed to moisture. Ruined plaster is useless, but review your storage facilities for future use.

Soft casts are usually the fault of a too high consistency (too much water in the mix) or of calcination. If the cast is dried too long or at too high a temperature it will become chalky.

Pinholes in casts are common. Excessive pinholing is probably caused by an improper mixing procedure. Either too much air has been mixed into the slurry, or insufficient time was allowed to let the plaster soak and become completely saturated. Mix the plaster carefully into the water and avoid splashing or entrapping air while mixing.

If a rough suface in the casts persist, it is probably caused by insufficient mixing. Mix the slurry until it is creamy throughout. This prevents the accumulation and settling of large "flakes" of plaster within the mix.

Cracks in a casting are caused by rough handling while removing the cast from the mold, when the plaster is weakest. Or it may be a result of exposing it to severe and quick changes in temperature. Sometimes, when the dryer is too hot, calcination of the plaster causes shrinking and cracking.

Mildew, a brown or greenish cast on the plaster, occurs when the plaster does not completely dry. The mildew can be washed off with bleach and subsequently dried. Check the humidity in the drying area as a possible cause of the problem. High humidity opposes drying.

Trapped air will cause pinholes or large voids. If the plaster is poured improperly, air is trapped in the mixture. Pour more evenly, and either vibrate the mold or tap it gently and repeatedly on the table to allow trapped air to escape. Pour plaster into the deepest portions of the mold first.

Paint will peel from a plaster casting that has not been completely dried.