THE BRICK INDUSTRY ASSOCIATION
TECHNICAL NOTES on Brick Construction
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Technical Notes 6 - Painting Brick Masonry
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INTRODUCTION

Although some masonry walls require protective coatings to impart color and help in resisting rain penetration, clay masonry requires no painting or surface treatment. Brick are generally selected because, among other characteristics, they have integral and durable color and, when properly constructed, are resistant to rain penetration.

Clay masonry walls may be painted to increase light reflection or for decorative purposes. Most paint authorities agree that, once painted, exterior masonry will require repainting every three to five years.

This issue of *Technical Notes* discusses general applications of paint to interior and exterior brick walls, and a brief discussion on specific paints suitable for brick masonry.

GENERAL

It is often erroneously assumed that brick masonry walls that are to be painted can be built with less durable materials and, in some instances, with less than extreme care in workmanship than would normally be used for unpainted brick walls. This is *not* the case. When a brick wall is to be painted, the selection of materials, both brick units and mortar, and the workmanship used in constructing the wall should all be of the highest quality; at least as good in quality as when the walls are to be left exposed. Every care should be taken to see that joints are properly filled with mortar to avoid the entrance of moisture into the wall, since it may become trapped behind the paint and cause problems. Every care should be taken to see that there are no efflorescing materials in the wall, either in the mortar, brick units or in the backup, since efflorescence beneath the paint film can also cause problems. See *Technical Notes* 23 Series.

Brick. Brick units to be used for walls that are to be painted should conform to the applicable requirements of the ASTM Specifications for Building Brick or Facing Brick, C 62 or C 216, respectively. The grade of units (which designates their durability) should not be lower than would be used if the wall were not to be painted. Grade SW is recommended. It may be acceptable to use brick units which are durable but differ in color in a wall to be painted. However, care should be taken that the units have similar absorption and suction characteristics so that the paint applied will adhere to all of the surfaces and have a uniform acceptable appearance.

Mortar. Mortar for brick masonry walls to be painted should conform to the Specifications for Mortar for Unit Masonry, ASTM C 270, Proportion Specifications. It is suggested that the mortar consist of portland cement and lime, and that the mortar type be selected on the basis of the structural requirements of the wall. See *Technical Notes* 8.

Paint. Paint for application to brick masonry walls should be durable, easy to apply and have good adhesive characteristics. It should be porous if applied on exterior masonry, thereby permitting the wall to breathe and preventing the trapping of free moisture behind the paint film.

CONSIDERATIONS FOR PAINTING CLAY MASONRY

In selecting a paint system for a brick masonry wall, the primary concern should be the characteristics of the surface and the exposure conditions of the wall. A primer coat may be of particular importance, especially where unusual or severe conditions exist.

Alkalinity. The chemical property of masonry which may have a significant effect on paint durability and performance is the alkalinity of the wall. Brick are normally neutral, but are set in mortars which are chemically basic. Paint products, which are based on drying oils, may be attacked by free alkali and the oils can become saponified. To prevent this occurrence, an alkaline-resistant primer is recommended.

Efflorescence. The deposit of water-soluble salts on the surface of masonry, efflorescence, is another factor that can hamper the performance of painted masonry. Efflorescence, which is present on the surface, should be removed and, once removed, the surface should be observed for reoccurrence prior to being painted. Methods of preventing and removing efflorescence are discussed in *Technical Notes* 23 Series, "Efflorescence-Causes, Prevention and Control".

Water and Moisture. Water or moisture in a masonry system will generally hamper the satisfactory performance of the painted surface. Moisture may enter masonry walls in any of several ways; through the pores of the material, through incompletely bonded or only partially filled mortar joints, copings, sills and projections, through incomplete caulked joints and improperly installed flashing or where flashing is omitted. In general, brick wall surfaces should be dry for painting. Acceptable moisture conditions for masonry walls to receive paint are listed in Table 1. The use of an electrical moisture meter may be used to measure the moisture content of a wall

TABLE 1
Dampness of Walls and Choice of Paint

Relative Humidity in Equilibrium with Surface Per Cent	Wall Condition	Electrical or Hygrometric Meter Indicator (not microwave meter)	Recommendation
100	Wet (with obvious moisture at wall surface)	Red Zone	Chances of failure high. Postpone painting if possible. If postponement is not feasible, wipe dry and use special types of paint[1] suitable under adverse conditions.
100	Wet (no obvious water at wall surface)	Usually Red Zone	Painting is best postphone. If essential, use: (1) White cement paint (2) Special types of paint[1]
90-75	Drying	Usually Amber Zone	As above. Other porous paints give reasonable chances of success. As surface becomes drier, range may be progressively increased to include: (1) Most emulsion paints (2) Special types of permeable flat oil paints
Less than 75	Dry	Usually Green Zone	No restrictions

[1]Some manufacturers offer special porous, highly pigmented emulsion paints which may give somewhat better results in very adverse conditions where delay is not acceptable.

SURFACE PREPARATION

General. Proper surface preparation is as important as paint selection. Because each coat is the foundation for all future coats, success or failure depends largely upon surface preparation. Thoroughly examine all surfaces to determine the required preparation. Previously painted surfaces often require the greatest effort. Before painting, remove all loose matter. Take special care when cleaning surfaces for emulsion paints and primers. They are nonpenetrating and require cleaner surfaces than solvent-based paints. Some paints can or should be applied to damp surfaces. Others must not. Be sure to follow directions accompanying proprietary brands.

New Masonry. As a general rule, new clay masonry is seldom painted. It is difficult to justify the extra expenditure for initial and future painting. However, if for any reason painting new masonry is desired, there are a few precautions necessary for reasonable success.

Do not wash new clay masonry walls with acid cleaning solutions. Acid reactions can result in paint failures. Use alkali-resistant paints. If low-alkali portland cement is not used in the mortar, it may be necessary to neutralize the

wall to reduce the possibility of alkali-caused failures. Zinc chloride or zinc sulfate solution, 2 to 3 1/2 lb per gal of water, is often used for this purpose.

Existing Masonry. Examine older unpainted masonry for evidence of efflorescence, mildew, mold and moss. While these conditions are not common, they all indicate the presence of moisture. Examine all possible entry points for water. Where necessary, repair flashing and caulking; tuckpoint defective mortar joints.

Remove all efflorescence by scrubbing with clear water and a stiff brush. A wall which has effloresced for a long time may present difficulties. The presence of moisture, the deposition of salts and the probable presence of alkalies are all factors which may contribute to the deterioration of paints.

If moss has accumulated on damp, shaded masonry, apply an ordinary weed killer. Wet the wall with clear water before applying weed killers to prevent them from being drawn into the wall. Chemical weed killers may contain solubles which can contribute to efflorescence or react unfavorably with paint, and should be removed after being used by scrubbing the wall with a stiff brush while rinsing with clear water.

Mildew seldom occurs on unpainted masonry. However, where present, treat it the same as on painted surfaces, discussed in the following paragraphs. Be sure to wet the wall before applying any cleaning solution. Clean small areas and rinse thoroughly. For further discussion on cleaning brick see *Technical Notes* 20 Revised, "Cleaning Clay Products Masonry".

Painted Surfaces. Previously painted surfaces normally require extensive preparation prior to repainting (refer to Table 2 for typical paint failures). Under humid conditions, mildew may have developed. Mildew may feed on a paint film or on particles trapped by the painted surface. If present, remove it completely before applying paint. Otherwise, growth will continue, damaging new paint. Mildew has been successfully removed by steam cleaning and sand blasting. The following is also effective:

3 oz trisodium phosphate (Soilax, Spic and Span, etc.), plus

1 oz detergent (Tide, All, etc.), plus

1 qt 5 per cent sodium hyperchlorite (Chlorox, Purex, etc.), plus

3 qt warm water, or enough to make 1 gal of solution.

Use this solution to remove mildew and dirt. Scrub with a medium soft brush until the surface is clean; then rinse thoroughly with fresh water. For small areas, use an ordinary household cleanser. Scrub with a medium soft brush and then rinse thoroughly. Use masonry paints containing a mildewcide to help prevent molds from recurring.

Remove all peeled, cracked, flaked or blistered paint by scraping, wire brushing or sand blasting. In some instances, old paint may be burned off, but this should be done only by skilled operators. Like efflorescence, paint blistering is caused by water within the masonry. Search for the water's source and take the necessary corrective measures to keep water out of the wall.

If alligatoring exists, remove the entire finish. There is no other means of correction.

If slight chalking has occurred, brush the surface thoroughly. However, if chalking is deep, remove by scrubbing with a stiff fiber brush and a solution of trisodium phosphate and water. Rinse the surface thoroughly afterwards. Use a penetrating primer to improve adhesion of the final coat.

Excessive paint buildup results from too many coats or excessively thick coats. Where it occurs, remove all paint and treat as a new surface.

Completely remove cement-based paints before repainting with other types. An exception to this rule is the use of cement-based paints as primers which will be covered by another paint within a relatively short time. If the wall will be repainted with another cement-based paint, wire brushing and scrubbing will suffice, providing treatments for mildew, efflorescence, etc. are not required.

TABLE 2
Types of Paint Failure

Defect	Description
Alligatoring	Wrinkling of the paint surface, caused by paint coats of different hardnesses
Bleeding	The working up of a stain into succeeding coats, imparting a discoloration to the newly applied coat
Blistering	Bubbles resulting from moisture trapped behind an impermeable paint film
Chalking	Powdering at or just beneath a paint surface Slight chalking may be normal due to weathering
Checking	A defect in organic paints, manifested by slight breaks in the film surface
Erosion	Wearing away by weathering
Excessive Paint Buildup	Result of applying too much paint or coats which are too thick
Flaking	Detachment of small pieces
Map Cracking	Breaks in a paint surface extending entirely through the paint film, usually caused by shrinkage
Mildew	Fungus growth sometimes found feeding on paint or particles adhering to the surface in damp places, generally black or gray in color
Peeling	A partial detachment of paint
Scaling	An advanced form of flaking

MASONRY PAINTS

Because all paints have distinct properties and because surfaces vary considerably, even the most experienced painting contractors carefully examine a surface before making recommendations. However, the following will generally indicate the proper use of masonry paints.

CEMENT-BASED PAINTS

For many years, cement-based paints have been satisfactory coatings for masonry surfaces. They achieved popularity because they have relatively good adherence and tendency to make a wall less permeable to free water. Cement-based paints are permeable, permitting the wall to breathe. Their main components are portland cement, lime and pigments. Additives, binders and sands may be added.

Although cement-based paints are more difficult to apply than other types, good surface protection results when properly applied. While they are not complete waterproofers, cement-based paints help to seal and fill porous areas, excluding large amounts of free water. White and light colors tend to be the most satisfactory. It is difficult to obtain a uniform coating with darker shades. Lighter colors tend to become translucent when wet, and dark colors become darker. Color returns to normal as the wall surface dries. Cement-based paints can provide a good base for other paints applied within a relatively short time.

The following procedure for applying paint on a properly prepared surface generally applies:

1. Cure new masonry walls for approximately one month before applying cement-based paints.

2. Dampen wall surfaces thoroughly by spraying with water.

3. Cement-based paints are packaged in powdered form. Because their cementitious components begin to hydrate upon contact with water, mix immediately prior to application for optimum results.

4. Apply heavy coats with a stiff brush, allowing at least 24 hr to elapse between coats.

5. During this time, keep the wall damp by periodically spraying it with water.

6. Apply additional coats in the same manner.

7. Keep the final coat damp for several days to properly cure.

WATER-THINNED EMULSION PAINTS

General Characteristics. Water-thinned emulsion paints, commonly referred to as latex paints, are relatively easy to apply. Water-thinned emulsions may be brush, roller or spray-applied. However, brush application is preferable, especially on coarse-textured masonry. Emulsion paints dry quickly, have practically no odor and present no fire hazard. They may be applied to damp surfaces, permitting painting shortly after a rain or on walls damp with condensation.

As a group, these paints are alkali-resistant. Hence, neutralizing washes and curing periods are not usually necessary before painting. Water emulsion paints possess high water vapor permeability and are known to have performed well on brick substrates that have been properly prepared.

Emulsion paints will not adhere well to moderately chalky surfaces. If possible, repainting should be done before the previous coat chalks excessively. However, specifically formulated latex paints are available containing emulsified oils or emulsified alkyds which facilitate wetting of chalky surfaces. This property enables the paint to bond the chalk together and to the substrate.

The principal water-thinned emulsion paint types are: butadiene-styrene, vinyl, acrylic, alkyd and multicolored lacquers.

Butadiene-Styrene Paints. These relatively low-cost, rubber-based latex paints develop water resistance more slowly than vinyl or acrylic emulsions. They are most satisfactory in light tints as chalking rate may be excessive in deep colors.

Vinyl Paints. Polyvinyl acetate emulsion paints dry faster, have improved color retention and a more uniform, lower sheen than rubber-based latex paints.

Acrylic Emulsion Paints. Acrylic emulsions have excellent color retention, permit recoating in 30 min or less, and have good alkali resistance. Acrylics have high resistance to water spotting and may be scrubbed easily.

Alkyd Emulsion Paints. Alkyd emulsions are related to solvent-thinned alkyd types, but have all the general characteristics of latex paints. They do have more penetration than most water-thinned emulsions, achieving better adhesion on chalky surfaces. Compared to other emulsion paints, these are rather slow to dry, have more odor, are not as resistant to alkalies, and have poorer color retention. Under normal exposure conditions, alkyd emulsions can serve as a finished coat over a suitable primer.

Multicolored Lacquers. A specialized paint group, multicolored lacquers are applied only by spray gun. The finished film appears as a base color with separate dots or particles of contrasting colors. These paints will cover many surface defects and irregularities. However, they must be applied over a base coat of another type; for example, polyvinyl acetate or acrylic emulsion paints.

FILL COATS

Fill coats are base coats for exterior masonry. They are similar in composition, application and uses to cement-based paints. However, fill coats contain an emulsion paint in place of some water, giving improved adhesion and a tougher film than unmodified cement paints. Fill coats have greater water retention, giving the cement a better chance to cure. This is particularly valuable in arid areas where it is difficult to keep the painted surface moist during the curing period.

SOLVENT-THINNED PAINTS

The five major solvent-thinned paints are oil-based, alkyd (synthetic resin), synthetic rubber, chlorinated rubber and epoxy. Oil-based and alkyd paints are *not* recommended for exterior masonry. Solvent-thinned paints should

be applied only to completely dry, clean surfaces. They produce relatively nonporous films and should be used only on interior masonry walls not susceptible to moisture penetration. The exception to this is special purpose paint, such as synthetic rubber, chlorinated rubber and epoxy paints.

Oil-Based Paints. Oil-based paints have been used for many years. They are relatively non-porous and recommended for *interior* use only. Although several coats may be required for uniform color and good appearance, they bind well to porous masonry. As with most solvent-based paints, they have good penetration on relatively chalky surfaces, but are highly susceptible to alkalies. New masonry must be thoroughly neutralized to avoid saponification. Available in a wide color range, oil-based paints are moderately easy to apply. Several days' drying is generally required between coats.

Alkyd Paints. Alkyd paints are similar to oil-based paints in most general characteristics. They may have slightly less penetration, resulting in somewhat better color uniformity at the cost of adhering power. Alkyd paints are more difficult to brush, dry faster and give a harder film than oil-based paints. These, too, are nonpermeable and are recommended for interior use only.

Synthetic Rubber and Chlorinated Rubber Paints. These paints have excellent penetration and good adhesion to previously painted, moderately chalky surfaces as well as new surfaces. They are reported to be more resistant to efflorescence and are generally good in alkali resistance. They may be applied directly to alkaline masonry surfaces, but are more difficult to brush on than oil paints. Darker colored synthetic rubber paints lack color uniformity. Both types have high resistance to corrosive fumes and chemicals. For this reason, they are often specified for industrial applications. Both types require very strong volatile solvents, a fire hazard which may prove undesirable.

Epoxy Paints. Epoxy paints are of synthetic resins generally composed of two parts, a resin base and a liquid activator. They must be used within a relatively short time after mixing. Epoxies can be applied over alkaline surfaces, have very good adhering power, and good corrosion and fume resistance. However, some types chalk excessively if used outdoors. Epoxies are relatively expensive and somewhat difficult to apply.

"HIGH-BUILD" PAINT COATINGS

High-build paint coatings are generally used on interiors to give the effect of glazed brick. Some coatings are based on two-component urethane polyesters and epoxies. Others are of an emulsion-based coat with acrylic lacquer. These paint systems usually include fillers to smooth out surface irregularities.

OTHER COATINGS

Heavily applied coatings of the so-called "breathing type" are available with either a water or solvent base. They are generally composed of asbestos fiber and sand, and applied thickly to hide minor surface imperfections. The presence of moisture on the surface of a masonry wall generally will not harm the latex type. Lower application temperatures of 35 F to 50 F on the other hand are less damaging to the solvent type.

For both types, adhesion is mostly mechanical because of low binder and high pigment content. Some coatings require special primers to insure adhesion. Although these coatings are reported to have given good performance on masonry, they tend to show stains where water runoff occurs.

These coatings are capable of allowing passage of water vapor, but cannot transmit large quantities of water that may enter through construction defects. Failure may occur as a result of freezing of water accumulation behind the film.

PAINTING NEAR UNPAINTED MASONRY

Often windows and trim of masonry buildings are painted with *self-cleaning* paints to keep surfaces fresh and clean. Unfortunately, self-cleaning is generally achieved through chalking. The theory is that rain will wash away chalked paint, constantly exposing a fresh paint surface. The theory works well, but too often no provision is made to keep chalk-contaminated rain water away from masonry surfaces. The result is usually more unsightly than dirty paint on trim or windows. *Avoid this staining by choosing nonchalking paints for windows and trim and by providing a means of draining water away from wall surfaces.*

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