

solution of 2 lb of potassium or sodium hydroxide to 1 gal of water to neutralize the acid. After the solution has been on the wall for 2 or 3 days, the white residue may be hosed off with clean water.

Manganese stain may occur on the surface of mortar or bricks containing manganese coloring agents. The stain may be tan, brown, or gray, is oily in appearance, and may streak down over the face of the wall. The manufacturing process chemically changes the manganese into compounds that are soluble in weak acid solutions. The staining may occur because of acid cleaning procedures, or even because of acid rain in some industrial areas. Muriatic acid solutions should never be used to clean tan, brown, black, or gray brick or mortar unless the wall is thoroughly saturated with water before application and the acids are washed away with a rinsing operation.

Brown manganese stains can be removed with a 1:1:6 solution of acetic acid (80% or stronger), hydrogen peroxide (30 to 35%), and water. Wet the wall thoroughly, and brush or spray on the solution, but do not scrub. The reaction is generally very quick and the stain rapidly disappears. After the reaction is complete, rinse the wall thoroughly with water. Although this solution is very effective, it is dangerous to mix and use, and proper precaution should be taken to protect workers and adjacent surfaces. Manganese stains often recur after they are first removed, and the process must be repeated. To avoid manganese stains, always request and follow the recommendations of the manufacturer in cleaning brick that contains manganese coloring agents.

16.2.3 Stains from External Sources

The method of removing externally caused stains will depend on the type of material that has been splattered on, or absorbed by, the masonry. Many stains can be removed by scrubbing with ordinary kitchen cleansers. Others require the use of a *poultice* or paste made with a solvent or reagent and an inert material. The stain is dissolved, and the solution leached into the poultice. After drying, the powdery substance remaining is simply brushed off. Although repeated applications may be required, the poultice will prevent the stain from spreading during treatment, by actually pulling it from the pores of the masonry. Some of the more common stains and cleaning methods are listed below.

Paint stains on both brick and concrete masonry may be removed with a commercial paint remover, or a solution of 2 lb of trisodium phosphate in 1 gal of water. Apply the liquid with a brush, allow it to remain and soften the paint, and then remove with a scraper and wire brush. Rinse the surface afterward with clear water.

Iron stains or welding splatter are removed from clay and from concrete masonry in different ways. On clay brick, spray or brush the area with a solution of 1 lb of oxalic acid crystals, 1 gal of water, and $\frac{1}{2}$ lb of ammonium bifluoride to speed the reaction. This solution should be used with caution because it generates hydrofluoric acid, which will etch the brick surface. The etching will be more noticeable on smooth masonry. An alternative method, which may also be used on concrete masonry, uses 7 parts lime-free glycerine with a solution of 1 part sodium citrate in 6 parts lukewarm water mixed with whiting to form a poultice. Apply a thick paste and scrape off when dry. Repeat the process until the stain has disappeared, then rinse the area thoroughly with clear water.

Copper or bronze stains are removed from both clay and concrete masonry by a mixture in dry form of 1 part ammonium chloride and 4 parts

powdered talc, with ammonia water added to make a thick paste. Apply the paste over the stain and remove when it is dry using a scraper or, if working on glazed masonry, a wooden paddle.

Smoke stains are difficult to remove. Scrubbing with a scouring powder that contains bleach using a stiff-bristle brush will generally work well. Small, stubborn stains are better dealt with using a poultice of trichloroethylene and talc, but the area should be well ventilated to avoid a buildup of harmful fumes. In some instances where large areas have been stained, alkali detergents and commercial emulsifying agents may be brush or spray applied or used in steam cleaners. If given sufficient time to work, this method will work well.

For information on identifying unknown stains and determining appropriate cleaning methods, consult Grimm's handbook, *Cleaning Masonry—A Review of the Literature*. All proposed cleaning methods should be tested on a small area before general application is made to a wall or surface.

16.3 CLEANING STONE MASONRY

Mortar is sometimes smeared on stone surfaces during construction. Mortar smears can usually be removed by scrubbing with stone dust and fiber brushes wetted with white vinegar. To avoid smearing mortar across the stone surface, allow the mortar to take its initial set, and then remove it with a trowel rather than wiping with a cloth. Mortar can also be placed into head joints with a grout bag to minimize the amount of wet mix coming in contact with the stone surface. Acids or chemical cleaners are not usually required to clean new stone. If stubborn dirt or other foreign substances have become embedded in the surface, mild abrasive cleaners will usually remove them. If more aggressive methods are required, consult the stone fabricator about the most appropriate cleaning chemicals and procedures. Cleaning methods for existing stone surfaces should achieve a balance between removal of dirt and stains and protection of the stone. Processes that are too abrasive can destroy the stone's natural protection and expose more surface area to the environment. Existing stone should be cleaned in accordance with the methods recommended under historic masonry below.

16.4 CLEANING HISTORIC MASONRY

There are more than just cosmetic reasons to clean and maintain historic masonry buildings. In fact, cosmetic reasons alone may not always be sufficient justification for a full-scale cleaning program. The weathered patina of masonry often becomes as much a part of a building's character as the materials themselves. The unnecessary cleaning of otherwise undamaged or lightly soiled walls may do more harm if harsh chemicals or abrasive action remove too much of the "protective crust" that has formed on the surface. As long as it does not contribute to or conceal deterioration, it should be preserved. The body of the brick or stone underneath may be too soft to withstand the attack of urban pollutants.

On the other hand, excessive soiling can disguise or even contribute to physical damage of the masonry. A heavy dirt buildup may easily conceal cracks and other signs of deterioration that warrant investigation and repair, and a thorough investigation may not be effectively accomplished without first cleaning the surface.

Dirt may also cause or aggravate deterioration of the masonry. Its presence significantly increases the amount of moisture that is attracted to and held on a wall surface, and impedes natural drying after a rain. Prolonged dampness tends to enhance the chemical reactivity of the masonry with com-