

CLEANING AND MAINTENANCE

1.0 INTRODUCTION

ASTM C1515-01 Standard Guide for Cleaning of Exterior Dimension Stone, Vertical and Horizontal Surfaces, New or Existing

1.1 Definition of Terms

Maintenance: Scheduled cleaning, specific procedures, and inspections performed on a daily, weekly, or other regular basis to keep the stone in proper condition.

Refinishing: Repolishing or honing of dull, once-polished marble, limestone, or granite floors and walls. Refinishing of traffic patterns, for example.

Renovation: Cleaning and repolishing of neglected dimension stone surfaces.

Restoration: Large-scale remedial actions taken to restore a structure or area to its original or acceptable "near original" condition. Generally applies to historic structures.

2.0 SLIP RESISTANCE OF STONE FLOOR SURFACES

The Americans With Disabilities Act (ADA) recommends that walking surfaces provide an adequate static coefficient of friction so as to provide a safe walking surface. Local building codes do take precedence. The MIA has had extensive ASTM C1028-96 Coefficient of Friction tests performed on a number of varieties of dimension stone. The results of those tests confirm that dimension stone used for paving provides an adequate walking surface when properly maintained. Proper maintenance includes prompt cleanup of spills and correcting other conditions that

can cause a sudden reduction in the static coefficient of friction of the floor.

3.0 BAD WEATHER SAFETY RECOMMENDATIONS

Wet Flooring Surfaces. All flooring surfaces can become slippery when wet. It is common courtesy as well as prudent management to reduce the hazards caused by wet flooring surfaces.

Spread carpeted runners from each outside door into lobbies and corridors to help dry shoe soles.

Pylons. Place bright-colored "slippery when wet" pylons on walking surfaces in conspicuous places.

Mop or shovel walking surfaces as often as necessary to remove standing water, ice, or snow.

Maintenance Instructions. Issue standard instructions to building maintenance personnel and prominently post at all janitorial workstations.

Local Codes. Follow local building and safety codes.

4.0 MOISTURE DAMAGE

Efflorescence. Water penetrating exterior wall cavities through defective flashing or unsealed joints can cause efflorescence, a mineral salt residue left on the surface of masonry when water evaporates. In addition, condensation in wall cavities prevented from reaching the exterior surface because of blocked weep holes can dislodge masonry in a freeze-thaw climate.

Moisture coming up through a floor slab seeks the easiest possible pathway to evaporate into the atmosphere. Often, the veining or microcracks in the structures of

some stones provide that path. The moisture dissolves all the salts from the ground, the substrate, and the stone, carries them to the surface, and deposits them as the moisture evaporates, giving the appearance of a faulty stone. Steps to eliminate this moisture can be implemented during the installation process (refer to chapters on Installation and Wet Areas.)

5.0 TOPICAL SEALERS AND IMPREGNATORS

Topical Sealers are coatings designed to protect the surface of stone against water, oil, and other contaminants. They are formulated from natural wax, acrylic, and other plastic compounds.

Impregnators (Penetrating Sealers). Impregnators penetrate below the surface and become repellents. They are generally hydrophobic (water-repelling), but are also oleophobic (oil-repelling). Impregnators keep contaminants out, but do not stop the interior moisture from escaping. These sealers are considered “breathable,” meaning they have vapor transpiration.

Treatment Type. The type of treatment (i.e., impregnator or topical sealer) that is applied to the stone must be determined by the type of stone and the environment of the application. All treatments must be applied in accordance with the Manufacturer’s specifications.

When to Use. A treatment may be used when a defined benefit can be determined. Situations in which a benefit may be derived from the use of surface treatments include:

- Where the risk of staining is present.
- As an aid in daily maintenance procedures.
- Where a coating may help to preserve the stone finish in excessively high wear conditions.

- Where weathering has or may affect the integrity of the surface of the stone.
- To prolong the aesthetic beauty of the original installation.
- Where the risk of graffiti or other vandalism is high.

6.0 MAINTENANCE OF INTERIOR STONE

Polished-finish stone has a glossy surface that reflects light and emphasizes the color and marking of the material. It is used in interiors as wall veneer, furniture and desk tops, counter and lavatory tops, tables, and tiles for commercial and residential installations.

Honed-finish stone has a satin-smooth surface with relatively little light reflection. It is generally preferred for floors, treads, thresholds, and other pedestrian traffic locations where heavy traffic would wear off a polished finish.

Normal Maintenance. All stone flooring should be dust mopped as necessary to remove debris and dirt. A dry, untreated dust mop should be used. Normal maintenance involves periodic washing with clean, potable water and neutral (pH 7) cleaners. Soapless cleaners are preferred because they minimize streaks and film. Mild, phosphate-free, biodegradable liquid dishwashing soaps or powders or stone soaps are acceptable if rinsing is thorough.

Wet the stone surfaces with clean water. Using the cleaner solution (following Manufacturer’s directions), wash in small, overlapping sweeps. Work from the bottom up if it is a vertical surface. Rinse thoroughly with clean, potable water to remove all traces of soap or cleaner solution. Change the water in the rinse pail frequently. Dry with soft cloth and allow to thoroughly air dry.

Safety Precautions. Any flooring surface, regardless of how it is finished, can be slippery when wet. Promptly remove liquids or foreign materials that might result in safety hazards before permitting pedestrian traffic.

For honed finishes, a neutral (pH 7), mildly abrasive cleaner may be used. Use only according to Manufacturer's directions.

For counter or table tops, use coasters under all glasses, particularly those containing alcohol or citrus juices. Many common foods, drinks, and cosmetics contain acids that will etch or dull the surface of many stones. Use trivets or mats under hot dishes and place mats under china, ceramics, silver, or other objects that can scratch the surface.

In food preparation areas, the stone may need to have an impregnator or topical sealer applied. If an impregnator or topical sealer is applied, it must be nontoxic and safe for use on food preparation surfaces.

Never use any acidic cleaner or chemical on marble or limestone surfaces. It is best to use a cleaner specifically formulated for stone cleaning.

7.0 EXTERIOR STONE

Exterior stone is a general term denoting stone installed in a place where temperature, moisture, and airborne contaminants are caused primarily or solely by the forces of nature. It can be used in a honed, textured, or polished finish in any mode in an exterior environment. Uses include building cladding, walkways, steps or stairs, retaining walls, paving, fountains, benches, planters, and decorative items such as sculptures.

Normal Maintenance. In accessible areas, routinely follow maintenance procedures as specified in Section 6.0 of this chapter, as applicable.

The large expanses of stone generally found on exterior applications may make it impractical to perform normal maintenance on a frequent basis. Large installations, however, should be given periodic overall cleaning as necessary to remove accumulated pollutants. Easily accessible stone surfaces such as steps, walkways, fountains, etc., should be kept free of debris and soiling by periodically sweeping and washing with water.

Normal maintenance should include periodic inspection of stone surfaces for structural defects, movement, deterioration, or staining.

8.0 STAIN REMOVAL

Surface stains can often be removed by cleaning with an appropriate commercial cleaning product or household chemical. Identifying the type of stain is the key to removing it. Look for color, shape, and environmental factors that could be causing the staining.

8.1 Types of Stains and Removal Procedures

Oil-Based Stains (grease, tar, cooking oil, cosmetics). An oil-based stain will darken the stone and normally must be chemically dissolved so the source of the stain can be flushed or rinsed away. Clean gently with a soft liquid cleanser, household detergent, ammonia, mineral spirits, or acetone.

Organic Stains (coffee, tea, fruit, tobacco, paper, food, urine, leaves, bark, bird droppings). May cause a pinkish-brown stain and may disappear after the source of the stain has been removed. Outdoors, with the sources removed, normal sun and rain action will generally bleach out the stains. Indoors, clean with 12% hydrogen peroxide and a few drops of ammonia.

Inorganic Metal Stains (iron, rust, copper, bronze). Iron or rust stains are orange to brown in color and leave the shape of the staining object, such as nails, bolts, screws, cans, flowerpots, or metal furniture. Copper and bronze stains appear as green or muddy brown and result from the action of moisture on nearby or embedded bronze, copper, or brass items. Metal stains must be removed with a poultice (see Section 9.0 of this chapter on Poultices). Deep-seated, rusty stains are extremely difficult to remove, and the stone may be permanently stained.

Biological Stains (algae, mildew, lichens, moss, fungi). Clean with dilute (1/2 cup in a gallon of water) ammonia, bleach, or hydrogen peroxide. **WARNING: DO NOT MIX BLEACH AND AMMONIA! THIS COMBINATION CREATES A TOXIC GAS!**

Ink Stains (magic marker, pen, ink). Clean light-colored stones with bleach or hydrogen peroxide. Use lacquer thinner or acetone for dark-colored stones.

Paint Stains. Small amounts can be removed with lacquer thinner or scraped off carefully with a razor blade. Heavy paint coverage should be removed with a commercial liquid paint stripper. **DO NOT USE ACIDS OR FLAME TOOLS TO STRIP PAINT FROM STONE.**

Water Spots and Rings (surface accumulation of hard water). Buff with dry 0000 steel wool.

Fire and Smoke Damage. Older stones and smoke- or fire-stained fireplaces may require a thorough cleaning to restore their original appearance. Commercially available smoke removal products may save time and effort.

Etch Marks. Caused by acids left on the surface of the stone, some will etch the finish but not leave a stain; others will both etch and stain. Once the stain has been removed, wet

the surface with clear water and sprinkle with marble polishing powder. Rub the powder into the stone with a damp cloth or by using a buffing pad with a low-speed power drill or polisher. Continue buffing until the etch mark disappears and the marble surface shines. Honing may be required for deep etching. This process may require the services of a Professional Refinisher.

Efflorescence. A white powder that may appear on the surface of the stone, it is caused by water carrying mineral salts from below the surface of the stone to the surface and evaporating. When the water evaporates, it leaves the powdery salt residue. If the installation is new, dust mop or vacuum the powder. Repeat as necessary as the stone dries out. Do not use water to remove the powder. If the problem persists, contact the Contractor to identify and remove the cause of the moisture.

9.0 POULTICES

9.1 General Application

Definition and Use. Applied to stone to remove stains, a poultice is a chemical or mixture of chemicals combined with an absorbent material, forming a thick paste. The poultice is spread over the stained area to a thickness of about 1/4" to 1/2" with a wood or plastic spatula or scraper, covered with plastic, and left to work for 24 to 48 hours. The chemical will draw out the stain into the absorbent material. Poultice applications may have to be repeated to thoroughly remove a stain, but some stains may never be completely removed.

9.2 Materials

Poultice materials include kaolin, fuller's earth, whiting, diatomaceous earth, powdered chalk, white molding plaster, and talc. Approximately one pound of prepared poultice material will cover one square foot.

Do not use whiting or iron-type clays such as fuller's earth with acid chemicals; the reaction will cancel the effect of the poultice. A poultice can also be prepared using white cotton balls, white paper towels, or gauze pads. Premixed poultices that require adding only water are also available from stone maintenance supply companies.

9.3 Poultice Mixtures for Various Stains

Oil-Based Stains. Poultice with baking soda and water or one of the powdered poultice materials and mineral spirits or a commercial degreaser.

Organic Stains. Poultice with one of the powdered poultice materials and 12% hydrogen peroxide solution, or use acetone instead of hydrogen peroxide.

Iron Stains. Poultice with diatomaceous earth and a commercially available rust remover. Rust stains are particularly difficult to remove; professional assistance may be required. Many rust removers contain acids that will etch marble, limestone, and certain granites.

Copper Stains. Poultice with one of the powdered poultice materials and ammonia. These stains are difficult to remove; professional assistance may be required.

Paint Stains (water-based). Poultice with one of the powdered poultice materials and a commercial paint remover.

Paint Stains (oil-based). Poultice with one of the powdered poultice materials and mineral spirits. Deep stains may require methylene chloride.

Ink Stains. Poultice with one of the powdered poultice materials and mineral spirits or methylene chloride.

Biological Stains. Poultice with one of the poultice materials and dilute ammonia or bleach or hydrogen peroxide. **WARNING: DO NOT MIX AMMONIA AND BLEACH! THIS COMBINATION CREATES A TOXIC GAS!**

9.4 Applying the Poultice

Prepare the poultice. If using a powdered poultice material, mix with the cleaning agent or chemical to a paste with a thick, creamy consistency. If using paper, soak in the chemical and let drain. Don't let the liquid drip.

Prepare stain area. Wet the stained area with distilled water.

Apply the poultice to the stained area about ¼" to ½" thick, and extend the poultice beyond the stained area by about 1". Use a wood or plastic scraper to spread the poultice evenly.

Cover the poultice with plastic and tape the edges to seal it. Punch several small holes in the plastic to allow vapor to escape.

Allow the poultice to dry thoroughly, usually about 24 to 48 hours. The drying process draws the stain out of the stone and into the poultice material. After about 24 hours, remove the plastic and allow the poultice to dry.

Remove the poultice from the stain. Rinse with distilled water and buff dry with a soft cloth.

Repeat the poultice application if the stain is not removed. It may take five or more applications for difficult stains.

If the surface is etched by the chemical, apply polishing powder and buff with a polishing pad recommended by the Polishing Powder Manufacturer.

10.0 EXTERIOR BUILDING CLEANING

General. The purpose of this section is to give the Specifying Authority the basic information to prepare a specification for the cleaning of exterior building stone.

Exterior building stone is considered in this section to be all stone used on the exterior of a structure, either as a structural component or as a facing material, with the exception of polished, finished marble. Even though polished marble is not recommended for exterior use, it is occasionally used on storefronts, column facings, and similar treatments.

Regular Cleaning. The ideal in maintaining exterior building stone is to clean it at periodic intervals (at least annually, depending on atmospheric conditions) by simply hosing down with clean water. This will prevent accumulation of dirt and impurities.

Sporadic Cleaning. If cleaning the stone is not done regularly, one of the water systems (hydraulic, hydro-air, plain water) will be the most effective method at the lowest cost.

Dirt on Older Buildings. Where dirt has accumulated on older structures over a long period of time, a combination of methods may have to be employed to properly clean the stone. Plain waterjet is satisfactory for removing most accumulation. No chemicals should be used which would be injurious to the stone.

Brushes may be necessary for the removal of certain surface impurities. Soft-fiber brushes are recommended.

Test Panels. By cleaning and inspecting test panels, the Specifying Authority can determine if the method is satisfactory. This procedure eliminates the possibility of improper cleaning, since the Owner and

Specifying Authority can see what results will be obtained prior to commencement of the total contract. It also gives the Cleaning Contractor a standard to work toward, making definition of the cleaning more specific for all parties concerned.

Further Reading Suggestions:

Cleaning Masonry – Review of the Literature by Grimm, Clayford T., P.E.
Construction Research Center,
University of Texas at Arlington, 1988.

Cleaning Stone and Masonry
Clifton, James R., Editor.
ASTM Special Technical Publication 935,
American Society for Testing and Materials,
1983.

Keeping It Clean
by Grimmer, Anne E.
U.S. Department of the Interior,
National Park Service, Washington, DC: U.S.
Government Printing Office, 1988.

“Cleaning of Masonry Interiors of Public Buildings,” Cleaning Stone and Masonry by Roth, J.W., ASTM STP 935, 1986.

“Chemical Cleaning of Historical Structures – A Practical Approach,” Cleaning Stone and Masonry by Rudder, T.H., ASTM STP 935, 1986.

“A Case Study of the Cleaning of Marble at the Schenectady, New York, City Hall,” Cleaning Stone and Masonry, by Waite, J.C. and R.J. Chen, ASTM STP 935, 1986.

“A Macrosteriogrammetric Technique for Measuring Surface Erosion Losses on Stone,” Cleaning Stone and Masonry by Winkler, E.M., ASTM STP 935, 1986.

Stain Removal Guide for Stone and Masonry
by Hueston, Frederick M., NTC Enterprises Inc.

Historic Stone & Tile Restoration Manual
by Hueston, Frederick M., NTC Enterprises
Inc., 1998.

11.0 SPECIFICATIONS BUILDING CLEANING

11.1 General

Information to be shown on drawings:

Location, size, or area and items to be cleaned.

Location, size, and number of test panels.

Areas not included in cleaning contract.

Location, size, and description of materials requiring protection.

Building and property boundaries.

11.2 Description

General. This section pertains to the furnishing of all labor, materials, equipment, and services necessary for the complete cleaning of exterior building stone as indicated on the plans and described in the specifications.

Repointing, Sealing, and Replacement. Repointing or sealing of joints and replacement of stone are not included in the cleaning contract.

Related Sections. To be determined by design requirements.

11.3 Requirements

General. The Plans, General Conditions, Supplementary General Conditions, and Executed Agreement are all a part of this section as if written out in full.

Certification. Furnish certified statements, as required, attesting that all materials to be used meet the requirements specified and approved.

Scheduling. Furnish Specifying Authority with schedule of cleaning operations indicating time of day work will be performed. The "wet method" of cleaning shall not be performed when temperatures reach 35°F or lower.

Test Area(s). Clean for approval by Specifying Authority at least a 4' x 4' test area for each type of soiling, stone variety, and finish required to be cleaned. Test panels shall be so located to include intersection of horizontal and vertical joints. The approved panel(s) shall be the standard for cleaning methods and finish of all areas to be cleaned.

Protection. Furnish for approval by Specifying Authority types of materials and methods to be used in the protection of adjacent materials and surfaces from damage, moisture, and staining. If other refurbishing operations are being conducted, protect cleaned stone areas with an approved nonstaining covering.

Cleaning. After the surface has been cleaned, it shall be rinsed with potable water applied at the temperature and pressure of the municipal water supply.

11.4 Materials

Water shall be potable, nonstaining, and free of materials detrimental to the surface being cleaned.

11.5 Methods

To be determined by approved test area(s).

Hydraulic. Water at varying pressures between 300 and 600 psi and at municipal supply temperatures shall be jetted against the surface to be cleaned. Care must be exercised

in selecting nozzle tip degree; 0 (zero) nozzle tips are never to be used.

Water Misting. Cleaning the surface with water. Misting heads are set up on scaffolding and water is misted onto the surface of the building. The misting heads may be set on a timer so that they go on and off intermittently. The intermittent cycle allows the building to dry and prevents over-saturation of the stone. This method is the safest for cleaning and is widely used on historical buildings.

Pressure washing employs the use of high-pressure waterjets of up to 2500 psi or more. Pressure washing works by blasting the dirt off the surface of the stone, and can cause irreversible damage to the stone surface. Pressure should never exceed 1000 psi and only a fan-tip spray nozzle should be used. This method should be employed only by highly trained technicians.

Chemical Cleaning is used in combination with one or several of the water washing methods to dislodge soiled particles. Chemicals can be dangerous to the stone, the Operator, and the surrounding landscape; therefore, all chemicals used must be tested and monitored.

Acids. Chemicals with a pH less than 7 should not be used on calcareous or dolomitic stones.

Alkalis. Chemicals with a pH greater than 7 are safe for use on most stones. These are usually followed with a mild acid wash to neutralize the alkaline salts.

Neutral Cleaners. Chemicals containing surfactants with a pH equal to 7 are safe for most stones.

Solvents. Waterless chemicals such as mineral spirits and acetone. Rarely used for

building cleaning due to their high flammability.

Bacteria. Application of special bacteria to "eat" dirt and salts.

J.O.S. System for removal of dirt and graffiti. Uses low-pressure washer and milled glass or dolomite powder. Prerinse required.

Dry Cleaning. Uses organic powder or mineral powder (aluminum silicate) crystals sized between 10 and 90 microns.

Sandblasting should never be used to clean stone surfaces.

Safety Requirements. All of these methods require specialized equipment. Adherence to OSHA safety requirements by highly skilled technicians is mandatory.

Testing. All methods must be tested for potential damage to the stone.

MIA Bookstore Resources:

A consumer brochure, "Care & Cleaning of Natural Stone Surfaces," can be purchased separately from the MIA Bookstore.