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Standard Guide for Cleaning of Exterior Dimension Stone, Vertical And Horizontal Surfaces, New or Existing[1]

This standard is issued under the fixed designation C 1515; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide describes materials and procedures which may be used to clean dimension stone exteriors as well as the conditions under which they may be used. It is intended to aid owners, maintenance supervisors and building managers, architects and engineers, and contractors clean vertical exterior dimension stone on commercial, residential and institutional structures. This guide may also be helpful to those who wish to clean stone masonry on bridges, retaining walls, ramps, and plazas, and free-standing stone objects such as statuary, memorials and grave markers.

1.2 This guide relates primarily, to routine maintenance of the surface finish of exterior dimension stone. The techniques noted herein may not be appropriate or cost effective with regard to restoration of disfigured, severely soiled or stained stonework, or of stonework of particular historic importance. In cases where staining occurs on surfaces which have cultural, civic, historic or architectural significance, consultation with a specialist is recommended.

1.3 The user of this guide must also obtain and have on file at both the job site and the office Material Safety Data Sheets (MSDS) describing the nature of all chemical products utilized during the cleaning process.

1.4 A file of literature from the manufacturers of all products involved within the scope of each project should be available for reference.

1.5 These procedures are not intended for interior stonework.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 119 Definition of Terms Relating to Dimension Stone[2]

C 503 Specification for Marble Dimension Stone[2]

C 568 Specification for Limestone Dimension Stone[2]

C 615 Specification for Granite Dimension Stone[2]

C 616 Specification for Quartz-Based Dimension Stone[2]

C 629 Specification for Slate Dimension Stone[2]

3. Terminology

3.1 This guide uses the term "qualified contractor," defined as a person, persons or organizations having expertise in stone cleaning, proved by documented projects demonstrating successful work, consistency in business or consultancy for a period of five or more years.

4. Significance and Use

4.1 Dimension stone is chosen for use in contemporary architecture in part because of its aesthetic appeal. Aesthetics can be significantly diminished when dirt, grime, fly ash, algae and other contaminants collect on the surface of stone.

4.2 This guide is intended to assist those who wish to preserve the original appearance of a new structure or to return a stone-clad building to its original color and appearance.

4.2.1 Note that cleaning may not be able to return discolored or faded stone to its original appearance.

4.3 This guide may be used as a construction document.

5. Description

5.1 "Exterior Dimension Stone" is a general term for a stone installed in a location where temperature, moisture and wind-carried contaminants are regulated solely or primarily by the forces of nature.

6. General Information

6.1 Exterior stone is used in honed, textured, or polished finishes in many modes in exterior environments. However, trade experience discourages the use of a polished finish marble or limestone on exterior applications due to susceptibility to damage by acids in rain or snow, and by wind-driven dirt particles.

6.2 The use of dark colored marbles and limestones for exteriors is discouraged because fading in direct sunlight has been experienced. Discolored or faded stone may not be able to be returned to its original color by cleaning.

6.3 Only marbles with an "A" Soundness Classification should be used for exterior installations. An exception is

[1] This guide is under the jurisdiction of ASTM Committee C18 on Dimension Stone and is the direct responsibility of Subcommittee C18.07 on Environmental Properties, Behavior, and Cleaning.

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[2] *Annual Book of ASTM Standards,* Vol 04.07.

travertine marble ("C" Soundness Classification) which may be installed with its natural voids either filled or unfilled.

6.4 Stone installed in a mortar bed should be allowed to cure properly. Do not apply surface treatments to stone set horizontally in a mortar bed for at least four weeks following installation.

6.5 Carefully identify all wet pedestrian areas with barricades, "danger" signs or bright red or orange-colored "danger" pylons.

7. Normal Maintenance

7.1 In accessible areas, routinely follow maintenance procedures as specified for Polished Stone, Honed Stone or Textured Finish Stone as applicable. The large expanses of stone traditionally found on exterior multi-story installations should be cleaned as often as necessary to remove accumulated pollutants.

7.1.1 A practice as simple as a hosing down with potable water on a regular basis will prevent accumulation of dust and acidic deposits left by rain or snow.

7.1.2 The cleaning of stone should be done only by qualified contractors who have the craftsmen, equipment, resources, and technical expertise to do the work, as well as make any repair, resetting, or repointing that may be necessary.

7.1.3 Generally, the processes used in multi-story cleaning will be similar to normal procedures, except that pumps for pressure wash, or steam and rinse water may be employed to economize on the amount of time necessary to the work.

7.1.4 Consult material suppliers and qualified contractors to obtain their recommendations for maintenance, materials or repairs.

7.1.5 Always test any cleaning method on a sample area to determine its effectiveness. Always refer to the manufacturer's instructions.

7.1.6 Always try the least aggressive cleaning media (potable water) first.

7.1.7 Evaluate project conditions with regard to required protection of adjacent properties and public safety. The protection needed for cleaning multi-story structures will differ from that needed for one or two-story buildings.

8. Polished Dimension Stone

8.1 Polished Stone has a glossy surface that reflects light and emphasizes the color and markings of the material.

8.1.1 Normal maintenance involves only periodic washing with clean, potable water and neutral (pH7) cleaners. "Soapless" cleaners are preferred because they minimize streaking and filming. Abrasive cleaners should be avoided.

8.1.2 Stone surfaces should first be wetted with clean, hot (not boiling) water. Then, using the cleaner solution (following manufacturer's directions) wash in small, overlapping sweeps from top down, or follow manufacturer's directions if different. Rinse thoroughly with clean, potable water to remove all traces of soap or cleaner solution. If rinsing is done by hand, change the water in the rinse pail frequently. Dry with a soft cloth, cotton flannel or chamois, wiping carefully to avoid streaks. The surface may also be allowed to air-dry.

8.1.2.1 **CAUTION**: Do not use bleach, acid, or strong alkali solutions on marble or limestone because colors may be lightened and the surface etched.

8.1.2.2 Select a cleaning agent which suits the nature of the stone.

9. Honed Dimension Stone

9.1 A honed finish is a satin smooth surface with relatively little light reflection.

9.1.1 Normal maintenance of a honed finish involves as-needed washing with clean, potable water and neutral (pH7), mildly abrasive cleaners.

9.1.2 Surfaces should be first wetted with hot, clean water. Then, using a mildly abrasive, alkaline cleaner and a medium bristle brush, wash in overlapping, swirling strokes. Work from top down or follow manufacturer's directions if different.

9.1.3 Rinse thoroughly then wipe dry with cotton, cotton flannel, or a chamois. Wipe carefully to avoid streaking. Or, allow to air-dry.

9.1.4 If further cleaning is needed, make a paste to the consistency of thick syrup by combining a mildly abrasive alkaline cleaning powder and clean, potable water. Apply the paste uniformly over the surface with a broad brush and allow to stand until dry. Then, use a medium bristle brush with additional water and scrub vigorously. (More cleaning powder may be applied at this point.) Rinse thoroughly and dry as described above. Follow manufacturer's directions.

9.1.4.1 See 11.1 and 11.2 for poultice information.

9.1.5 **CAUTION**: Do not use bleach, acid, or strong alkali solutions on marble or limestone because colors may be lightened and the surface etched.

9.1.5.1 Select a cleaning agent which suits the nature of the stone.

10. Textured Finish Dimension Stone

10.1 Examples of textured finish dimension stone include Thermal Finish Granite, Thermal Finish Limestone, Unfilled Travertine, Rock Face, Split Face, Natural Cleft Slate and Natural Cleft Quartz-Based (Sandstone) Stone. Abrasive, bush-hammered, and sand-blasted finishes are also included in this category.

10.1.1 Regular maintenance becomes difficult if dirt is allowed to accumulate on the uneven surfaces of these stones. If convenient, textured finished stone may be vacuumed clean.

10.1.2 Normal maintenance of textured finish stones involves as-needed washing with clean, potable water and neutral (pH7), mildly abrasive cleaners.

10.1.3 Surfaces should first be wetted with hot, (not boiling) clean water. Then, using a mildly abrasive, alkaline cleaner and a medium bristle brush, wash in overlapping, swirling strokes. Work from top to bottom. Rinse thoroughly with clean water.

10.1.4 **CAUTION**: Do not use bleach, acid, or strong alkali solutions on marble or limestone because colors may be lightened and the surface etched.

10.1.4.1 Select a cleaning agent that suits the nature of the stone.

11. Stain Removal

11.1 *General Poultice Method*:

11.1.1 The General Poultice Method is a special cleaning procedure for removal of deep-seated, time-set dirt and grime.

The poultice may be applied to honed or textured stone, and is particularly useful on intricate carvings, moldings and other detailing difficult to scrub. The general poultice is essentially a strong cleaner, applied by way of a holding medium, that concentrates its effort over a period of time.

11.1.1.1 A poultice applied to polished finish marble will dull the surface, requiring repolishing.

11.1.2 The poultice is used primarily to attack and reduce heavy deposits of normal soiling, or to remove stains resulting from the action of moisture on normal soiling.

11.1.3 For stains resulting from a known origin, see Section 12.

11.2 *Preparation and Application of a Poultice*:

11.2.1 Mix kaolin or Fuller's earth with either a common laundry bleach or a commercial hair-bleaching solution of hydrogen peroxide (H_2O_2) to form a paste the consistency of peanut butter or cake icing. (For estimating purposes, figure a consumption rate of one pound of paste per square foot of surface.)

11.2.2 Moisten the surface of the stone with the same liquid used to make the paste, wetting beyond the extent of the stained areas.

11.2.3 Apply the poultice paste to the stone with a wooden or plastic spatula, insuring a uniform coat about ¼-in. thick. Cover the entire area to be cleaned and somewhat beyond to prevent the soil from being forced into the clean stone. Insure the poultice is in full contact with the stone with no entrapped air pockets or voids.

11.2.4 Tape plastic sheeting over the poulticed area to prevent quick drying-out and to allow it to act for 48 h.

11.2.5 After this standing period, dampen the poultice with clean, cool water to prevent undue dust generation. Remove the poultice with a wood or plastic spatula to avoid scratching. Rinse the cleaned area thoroughly with clean water; blot or wipe off excess water; allow it to dry.

11.2.6 When water-spotting has disappeared after complete drying, inspect for remaining soil. A second poultice application may be necessary.

11.2.7 **CAUTION**: Do not use a poultice containing additives (such as bleach or solvent) other than water on dark colored stone.

11.2.8 Commercial "Marble Poultice" base powders are available. Read the manufacturer's directions before application.

12. General Stain Removal

12.1 A regular normal care and maintenance program should help prevent staining. But should accident or neglect contribute to the problem, remedial measures will be completely different from general cleaning and will usually require persistence to achieve the desired results.

12.2 When the source of the stain is not known, the ″Poultice Method″ should be tried first. If this remedy is not effective, follow specific remedies as explained below, attempting each in turn until results are achieved. Please note the **CAUTION** (11.2.7) against the application of poultice containing additives other than water on dark colored stone.

12.3 Stains in stone will generally be caused by one of three major category sources: organic materials, metallic materials, or oils and greases.

12.4 As a general rule, begin maintenance with simple methods and progress to more aggressive treatments as necessary.

13. Removal of Organic Stains

13.1 Most organic (carbon-oxygen based) stains require an oxidizing agent treatment, and will generally respond in varying degrees to hydrogen peroxide or commercial chlorine bleach treatments and poultices. Hydrogen peroxide (H_2O_2) in a hair-bleaching solution can be used. Chlorine bleaches in commercially available strengths as sold for laundry and household use can be used.

13.1.1 **CAUTION**: Do not combine bleach and ammonia. The combination produces a toxic gas.

13.1.2 **CAUTION**: Do not use a poultice containing bleach, acid, or strong alkali solutions on marble or limestone because colors may be lightened and the surface etched.

13.1.3 In the presence of moisture, leaves, bark, bird and animal droppings, and foods may cause pinkish-brown stains. When the sources are removed, normal sun and rain action will generally eliminate the stains. Tobacco stains usually respond in the same manner.

13.1.4 Urine stains on light-colored stone should be attacked with a strong chlorine-bleach poultice, or sprinkled with a chlorine-bleaching powdered cleanser, dampened, and left until dry, then washed with clean water. Or, they can be simply rinsed and allowed to bleach in the sun.

13.1.5 Fire and smoke stains, caused by burning wood or paper, can be removed with the application of a commercial Fireplace Cleaner, or by washing the stained surface with a solution of caustic soda (lye: sodium hydroxide) (NaOH).

13.1.6 **CAUTION**: Caustic soda is corrosive. Care must be taken to protect skin, eyes, and clothing from burns. If contact occurs, rinse the contact area with cool, clean water.

14. Removal of Metallic Stains

14.1 Metallic stains require chemical treatment with a reduction agent, that is, an agent that will attack the metallic salts and reduce them to soluble, colorless salts which can be rinsed away or drawn out by poultices.

14.2 *Iron (Ferrous or Ferric) Stains*—These generally appear reddish-brown, resembling rust, and result from the action of moisture on adjacent or embedded iron or steel. Before trying to remove this stain, cure the cause. Clean and paint accessible ferrous items to prevent oversplash and run-off onto the stone. If possible, remove the sources of moisture to prevent further oxidation. Where the iron or steel is embedded in stone little can be done except to cut off the moisture supply to the metal to prevent a continuation of oxidation and resultant staining.

14.2.1 Superficial, fresh stains can usually be removed with a vigorous scrubbing. Seated stains may be removed by the application of a commercial rust remover following manufacturer's directions for use. If these remedies fail, often abrasion with a scouring powder followed by a second application of the commercial rust remover will remove the stain.

14.2.2 Should this fail, apply a poultice for not more than ½

h using either sodium hydrosulfite ($Na_2S_2O_4$) or sodium hypochlorite (NaOCLO. SH_2O). Flush with a sodium citrate solution ($C_6H_5Na_3O_7..2H_2O$).

14.2.3 Unfortunately, deep seated, rusty stains caused by prolonged neglect or from embedded metal (anchors, ties, etc.) may not be removable by any means.

14.3 *Copper and Bronze (Cuprous and Cupric) Stains*—These stains appear as green or muddy-brown colorations and result from the action of moisture on nearby or embedded bronze, copper and brass items.

14.3.1 Before attempting stain removal, cure the cause. Clean attached or nearby metal items and coat them with a quick drying, clear coating such as varnish, shellac, or a plastic spray-on or brush-on coating. If possible, remove sources of moisture to prevent further oxidation of cuprous metal. When the source of the stain is an embedded anchor, tie or other device, the only remedy is to cut off moisture at its source. Coating would be impossible.

14.3.2 After eliminating the moisture or protectively coating the metal, attack the stain with a poultice. Mix a thick paste composed of kaolin or fuller's earth, ammonia, or sal ammoniac (ammonium chloride) (NH_4CL), (which can be purchased at most pharmacies) to the consistency of peanut butter or cake icing. If sal ammoniac is not available, a fairly effective "field expedient" is a solution of household ammonia and table salt mixed in equal quantities into the poultice base. Apply the poultice thickly beyond the limits of the stain, and leave it until dry. Remove with a non-metallic spatula and rinse thoroughly. Cover with plastic and allow to dry. Repeat if necessary.

14.4 *Lead*—Stains caused by lead will appear as yellow or orange colorations and may appear at a distance from the source. There is no use attacking the stain if the source cannot be removed, or even attacking the stain itself inasmuch as lead is virtually non-reactive to chemicals, and any lead salts that may have formed will be extremely difficult to reduce. If the source can be removed, the stains may bleach out through normal weathering.

14.5 *Ink*—Inks are frequently formulated from metallic salts, and the stains caused by these inks should be attacked with the same methods as recommended for iron stains.

14.5.1 Non-metallic ink stains can frequently be removed using a poultice or white blotter soaked with household ammonia. Rinse thoroughly with clean water. Often, a bleaching poultice will be needed to remove any remaining coloration.

14.5.2 **CAUTION**: Do not combine bleach and ammonia. The combination produces a toxic gas.

14.6 *Removal of Oil and Grease Stains*:

14.6.1 Oil, grease, linseed oil, and perspiration stains normally must be dissolved chemically so the source of the stain can be flushed or rinsed away.

14.6.2 Acetone (dimethyl ketone)(CH_3COCH_3) is a compound that dissolves most oils and greases. Mineral spirits and unleaded gasoline can be used as substitutes for acetone.

14.6.3 **CAUTION**: The use of flammable or explosive liquids in cleaning operations is dangerous and should be avoided whenever possible.

14.6.4 After removing as much of the source of the stain as possible, make a poultice, or saturate a white blotter with the solvent, and apply over the remaining stain, covering beyond the stain's limits. Allow the solvent to dry, remove the poultice (if applied) and rinse with water. Repeat if necessary.

14.6.5 Do not use solvents containing coloring agents or oils. Avoid turpentine, leaded gasoline and kerosene.

14.7 *Removal of Paint and Paint Stains*:

14.7.1 Paint should be removed only by use of a commercial, "heavy liquid" paint stripper. Such strippers are normally hydroxide types, containing caustic soda or lye. If these products are used, protect face and skin. Rinse with clean water to remove spills.

14.7.2 **CAUTION**: Do not use acids or flame tools to strip paint from stone.

14.7.3 Follow manufacturer's directions for use of commercial products. Flush treated areas profusely with clean water after application. Use only wood or plastic scrapers and stiff fiber or jute brushes for removing sludge and curdled paint.

14.7.4 Normally, latex and acrylic paints will not cause staining. Oil-base paints, linseed oil, putty, and architectural caulks and sealants may cause oily stains. These stains should be attacked as described above.

14.7.5 When removing paint and paint stains from vertical surfaces, take care to protect unpainted stone from run-off. If oil-based paint is accidently dripped or overrun, remove immediately with a clean cloth followed at once by wiping with a cloth soaked in acetone or mineral spirits to prevent oil-staining. Latex paint drips should be wiped off or washed away immediately with a damp cloth.

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