



# Standard Guide for Selection of Cleaning Techniques for Masonry, Concrete, and Stucco Surfaces<sup>1</sup>

This standard is issued under the fixed designation E 1857; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This guide outlines procedures for the selection and assessment of cleaning techniques for removing soiling and staining from masonry, concrete, and stucco surfaces. Removal of paints, coatings, and graffiti may require measures beyond the scope of this guide. New construction is excluded from the scope of this guide.

1.2 This guide does not purport to address the causes of soiling or staining or to propose remedies for recurring soiling or staining.

1.3 Where work on surfaces of artistic, architectural, cultural, or historic significance is being considered, guidance from specialists should be sought.

1.4 This guide does not purport to address removal and replacement of prior repairs, repair of damaged surfaces, or other irregularities that contribute to the uneven or discolored appearance of masonry, concrete, and stucco surfaces.

1.5 *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 limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- C 43 Terminology of Structural Clay Products<sup>2</sup>
- C 119 Terminology Relating to Dimension Stone<sup>3</sup>
- D 4262 Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces<sup>4</sup>
- E 631 Terminology of Building Constructions<sup>5</sup>

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, see Terminology C 43, C 119, or E 631.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *coating*—clear or pigmented surface treatment applied for aesthetic improvement, enhanced durability, or other purpose.

3.2.2 *contaminant*—a foreign substance not intentionally introduced to a surface.

3.2.3  *muriatic acid*—commercial grades of hydrochloric acid that often contain iron impurities.

3.2.4 *nebulized water spray*—cleaning with a mist of water from fine nozzles.

3.2.5 *poultice*—cleaning systems composed of one or more liquids mixed with powder to form a paste.

3.2.6 *soiling*—a deposit of finely divided particulate matter or other contaminants adhered to the surface.

3.2.7 *soiling crust*—accumulation of soiling into a hardened layer at the surface. Partial or complete detachment of the crust may damage the substrate.

3.2.8 *staining*—a contaminant that has penetrated the surface.

3.2.9 *surface*—the exposed face of masonry, concrete, or stucco.

## 4. Significance and Use

4.1 Cleaning of masonry, concrete, and stucco surfaces is undertaken for a variety of reasons including aesthetic improvement, removal of contaminants, maintenance, and surface preparation. This guide provides for selecting, testing, and evaluating cleaning techniques for removal of soiling and staining.

4.2 Cleaning systems may adversely affect both building materials being cleaned as well as other materials, mechanical, electrical, and other building systems, and building exterior, interior, and site features.

4.3 In some situations, it may be prudent to spot clean or to not clean.

4.4 It should be noted that, in some cases, cleaning may be inconsistent with the goals of historic preservation.

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.24 on Building Preservation and Rehabilitation Technology.

Current edition approved Jan. 10, 1997. Published March 1997.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 06.02.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 04.11.

## 5. Identification and Characterization of Substrate

NOTE 1—The substrate should be identified and characterized before a cleaning method is selected. Building records and any other relevant historic sources should be reviewed for information about the substrate and any previous treatments that might affect the proposed cleaning process.

5.1 Substrate samples should be analyzed to describe the following characteristics:

- 5.1.1 Mineralogical composition of major constituents,
- 5.1.2 Microtexture,
- 5.1.3 Water solubility,
- 5.1.4 Acid solubility,
- 5.1.5 Water absorption, and
- 5.1.6 Soluble salt content.

NOTE 2—ASTM describes specific test methods for each masonry type. Judgment should be used to select the current test method appropriate to the proposed cleaning project. Tests may be modified to accommodate the number and size of available samples.

## 6. Identification of Soiling and Staining

6.1 Identification of the composition of soiling or staining present on surfaces to be cleaned will assist in determining appropriate cleaning techniques for testing. This may be accomplished through laboratory testing. Cleaning techniques should always be further evaluated in test areas.

## 7. Selection Criteria

7.1 Performance goals for cleaning masonry, concrete, or stucco surfaces should be established prior to selection of the cleaning technique.

7.2 Selection of cleaning techniques shall be based on the following factors:

- 7.2.1 The level of cleanness desired,
- 7.2.2 The effectiveness of the cleaning system,
- 7.2.3 Adverse effects to the surfaces, substrates and related components, and adjacent surfaces,
- 7.2.4 Environmental concerns, such as human exposure and the collection, neutralization, and disposal of cleaning residue and run-off, and
- 7.2.5 Other practical considerations such as time and cost factors.

## 8. Cleaning Techniques

NOTE 3—The following cleaning techniques are not necessarily listed in order of aggressiveness. It is the responsibility of the user of this guide to determine the advantages and disadvantages of the various cleaning procedures as they relate to the surfaces being cleaned. Whenever possible, contact the masonry, concrete, or stucco manufacturers and suppliers, the cleaning product manufacturers, and the cleaning equipment manufacturers to determine compatibility. Specialists may also be consulted.

8.1 *Water Cleaning*, relies on the ability of water to dissolve, swell, and loosen soiling and staining, enabling their removal from the surface. Mechanical scrubbing may enhance removal when staining is deeply deposited.

8.1.1 The effectiveness of water cleaning is influenced by the following factors:

8.1.1.1 *Pressure Rating*, refers to the gauge pressure measured at the nozzle of the cleaning equipment. Equipment

capable of generating a pressure of 100 to 3000 psi (0.7 to 20 MPa) is commonly used. Surfaces and substrates can be damaged by abrasion. Testing should determine the minimum effective pressure. The location of the pump with respect to the nozzle can affect the pressure rating.

8.1.1.2 *Water Flow Rate*—Water supplied by the pump to the rinsing apparatus measured in gallons per minute (gpm) or litres per minute (L/min). Pumps delivering 1.5 gpm (3.8 L/min) may be used effectively in cleaning operations that require containment or control of effluent. More efficient cleaning is generally achieved with equipment providing a flow rate of 4 to 8 gpm (15 to 30 L/min).

8.1.1.3 *Spray Tip*, determines the size and configuration of the water spray delivered to the substrate. Fan-type spray tips producing 15 to 40° fan spray patterns have proven most effective for cleaning masonry, concrete, and stucco surfaces. Laser tips, 0° tips, or fan spray tips with less than 15° spray patterns produce a concentrated stream of water that may damage surfaces. Rotating spray heads that produce a scouring action may also damage surfaces. Care must be taken to keep the spray tip as far from the surface as possible to provide effective cleaning. Water from a spray tip held 3 ft (0.9 m) from the substrate may have no adverse effect on the surface but may remove the surface of the substrate when held 6 in. (150 mm) from the wall.

8.1.2 *Water Cleaning Methods*:

8.1.2.1 *Nebulized Water Spray*—Effective for removal of soiling or other deposits from surfaces that could not withstand high pressure water or abrasive cleaning techniques.

8.1.2.2 *Pressure Water Spray*—Effective for removal of loosely adhered soiling.

8.1.3 *Limitations*—Problems associated with water cleaning include intrusion of water into interior spaces, brown staining when iron-containing minerals are present, and the encouragement of biological growth. When water pressures are excessive, the surface can be abraded. Metal tools should not be used as scrubbing implements.

8.2 *Chemical Cleaning*, relies on chemical reaction to dissolve, capture, or mobilize soiling or staining. Chemical cleaning utilizes detergents, organic solvents, acids, and alkalis. Cleaning compounds, which are often proprietary products, are available as water-thin liquids and as thickened gels. Poultices can be used for removal of stains. Use of a chemical in conjunction with water washing reduces both the chemical concentrations and the water volume required. In most cases, chemical cleaning should be preceded and followed by thorough water rinsing. Poultices enhance removal when staining is deeply deposited.

NOTE 4—Application frequently involves use of proprietary chemical cleaning compounds. Products should be used in accordance with the manufacturer's recommendations for suitability, protection, dilution, application, surface contact times, and rinsing procedures.

8.2.1 *Chemical Types*:

8.2.1.1 *Detergents*—Suitable for removal of dust, dirt, water soluble surface contaminants, oil, grease, and other emulsifiable staining materials. Water-detergent solutions can be acidic, alkaline, or pH neutral. Neutral pH detergents are sometimes referred to as nonionic.