

## **1. Scope**

- 1.1. This standard establishes consistent procedures for the specification of utilizing pressurized water to clean surfaces or prepare surfaces for painting.
- 1.2. This standard establishes a concise methodology for the use of pressurized water in cleaning and preparing surfaces.
- 1.3. This standard establishes performance criteria using a consistent protocol to be followed when pressurized water is used to clean surfaces.
- 1.4. This standard establishes performance criteria when the project specifications do not provide explicit (adequate or complete) instructions regarding the elements that affect cleaning action when using pressurized water.

## **2. Significance & Use**

- 2.1. For the scope of this standard, the term pressurized water refers to cleaning and paint preparation. Terms commonly used are “power washing”, “pressure cleaning”, “pressure washing”, “water cleaning”, “water blasting”, and/or “water jetting”.
- 2.2. This standard applies to all surfaces, both previously coated and uncoated.

## **3. Reference Standards & Documents**

- 3.1. American Society for Testing Materials (ASTM) D4258-05 Standard Practice for Surface Cleaning Concrete.
- 3.2. Environmental Protection Agency (EPA) Model Ordinance.
- 3.3. Master Painters Institute (MPI) Repainting Manual Surface Preparation Standards.
- 3.4. The Master Painters Glossary Version- Painting and Decorating Terminology Version 4.0, 2004.
- 3.5. Painting and Decorating Contractors of America (PDCA) Standard P5 Benchmark Sample Procedures for Paint and Other Decorative Coating Systems.
- 3.6. PDCA, Estimating Guide, Volume 1, Practices and Procedures 2009.
- 3.7. PDCA, Estimating Guide, Volume 2, Rates and Tables, 2009.
- 3.8. Power Washers of North America (PWNA) Cosmetic Cleaning BMPs based on the EPA’s Model Ordinance 2011.
- 3.9. Society for Protective Coatings (SSPC)-SSPC- SP12/ NACE (NACE International- The Corrosion Society) No. 5 Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating, Joint Standard 2002.
- 3.10. SSPC-SP1 Solvent Cleaning.

- 3.11. SSPC-SP13/ NACE No. 6 Surface Preparation of Concrete.
- 3.12. SSPC Good Painting Practice Vols. 1 & 2.

#### 4. Definitions

- 4.1. ABRASIVES: Materials used for wearing away a surface by friction, such as powdered pumice, silica, sandpaper, metal shot, mineral slags, steel wool, or glass beads. Also, used for abrasive blast cleaning, e.g. sand, grit, carborundum, baking soda, rice hulls, ground walnut shells, etc. [MPI]
- 4.2. CLEAN: Free of dirt or pollution [Merriam- Webster’s]
- 4.3. CONTAINMENT: The act, process, or means of containing. [Merriam- Webster’s]
- 4.4. CONTAMINANT CONTAINMENT: Something that contaminates . [Merriam- Webster’s]
- 4.5. CONTAMINATE: To soil, stain corrupt or infect by contact or association; to make inferior or impure by admixture; to make unfit for use by the introduction of unwholesome or undesirable elements. [Merriam- Webster’s]
- 4.6. EFFLUENT: A discharge of a pollutant into a water source. [MPI]
- 4.7. GOUGE: A groove or cavity scooped out; an excessive or improper extraction. [Merriam- Webster’s]
- 4.8. HOT WATER: Water Temperature over 110° F. (EPA)
- 4.9. OSCILLATING: Swinging backward and forward like a pendulum; moving or traveling back and forth between two points. [Merriam- Webster’s]
- 4.10. POWER WASHING: See water blasting – Methods using pressurized water to remove surface contaminants from a substrate in preparation for painting or coating. Standards for wood, masonry, concrete, metal, etc. for Architectural projects are included in MPI RSP-5 and are published in MPI. Included are:
  - Power washing 100-600 psi @6”
  - Power washing 600-1500—psi @6”
  - High pressure washing 1500-4000 psi @ 6”- 12”
  - Hydro blasting 4000-10,000 psi Jet blasting 10,000+ psi
  - Standards for steel and other hard materials for industrial projects are included in SSPC SP-12 and are published by SSPC. Included are:
    - Low-pressure water cleaning <5000 psi High-pressure water cleaning 5-10,000 psi High-pressure water jetting 10- 25,000 psi
    - Ultrahigh-pressure water jetting >25,000 psi [MPI}
- 4.11. PRESSURIZE: To confine the contents under a pressure greater than the atmosphere [Merriam- Webster’s]

- 4.12. PROFESSIONAL: Of or relating to or characteristic of a profession; characterized or conforming to the technical or ethical standards of a profession; exhibiting a courteous, conscientious and generally businesslike manner in the workplace; having a particular profession as a permanent career. [Merriam- Webster's]
- 4.13. SCORING: Lines (as scratches or incisions) made with or as if with a sharp instrument. [Merriam- Webster's]
- 4.14. SPALLING: The chipping or fragmenting of surface or surface coating caused, for example, by differential thermal expansion or contraction. Spalling, in concrete substrates, is generally attributed to the absorption of water with subsequent freezing, although it also occurs due to the rusting and subsequent expansion of reinforcing bar (rebar) close to the surface. [MPI]
- 4.15. SUBSTRATE: A variant of substratum. In painting, any surface to be painted, including wood, concrete, masonry, steel, other metals, and various other materials or previous paints. A substrate can therefore be bare or covered. A previously unpainted surface sometimes is called the "original substrate". [MPI]
- 4.16. SURFACE: An area, or substrate, to which paints, coatings, or wall coverings are applied. The character of the area. [MPI]
- 4.17. SURFACTANT: An acronym for Surface Active Agent. Used to break down the surface tension of liquids to make them more miscible, such as in oil and water emulsions. Surfactants are divided into smaller classes that are relative to their functionality such as dispersants, emulsifiers, detergents, defoamers, etc. Surfactants have an electrochemical charge associated with them and can be classified by the polarity of the charge; anionic - negative, cationic - positive, nonionic - no charge and amphoteric - positive or negative depending on certain conditions (pH, phase, etc.). [MPI]
- 4.18. TRAINED: Having undergone instruction, discipline or drill [Merriam- Webster's]

## 5. Standard Specification

- 5.1. Cleaning with pressurized water is performed both for cleaning surfaces only and as preparation for both sealing and painting.
- 5.2. The cleaning action achieved when utilizing pressurized water is a function of nine elements;
- 1) the pounds per square inch (PSI)
  - 2) the gallons per minute (GPM)
  - 3) the tip size (the appropriate tip size selection is determined by GPM & PSI)
  - 4) the distance of the tip from the surface being cleaned and angle in which the gun/tip is held in relation to the surface
  - 5) nozzle type
  - 6) chemicals (pre-spray or injection into the pressure stream)
  - 7) temperature of the water

8) abrasive injected into the water stream, i.e. blasting media such as silica sand, baking soda, and volcanic ash)

9) speed at which the tip passes over the surface

- 5.2.1. In general, as the PSI is increased, while keeping all other elements the same, the cleaning intensity is increased. However, as the PSI is increased, damage to softer or malleable substrates may occur. A trained professional/ operator must understand the cause and effect of changing the PSI. Gun/tip distance and angle and speed at which water stream passes over substrate must be adjusted accordingly.
- 5.2.2. In general, as the GPM is increased, while keeping all other elements the same, the cleaning production is increased with less potential damage to softer or malleable substrates. A trained professional operator must understand the cause and effect of changing the GPM. Gun/tip distance and angle and speed at which water stream passes over substrate must be adjusted accordingly.
- 5.2.3. Various tip sizes may be utilized when cleaning with pressurized water. For effective cleaning performance, appropriate tip size and type must be matched to the surface material, substrate material, and contaminants being removed. Consideration of PSI and GPM is essential.
- 5.2.4. The specification and/or trained professional operator of the equipment using pressurized water must determine:
  - 5.2.4.1. the optimal distance that the tip must be held from the surface.
  - 5.2.4.2. the gun/tip angle in relation to the surface.the GPM and PSI of the equipment.
  - 5.2.4.3. the size and type of tip.
  - 5.2.4.4. the chemicals/surfactants if necessary. the temperature range of the water.
  - 5.2.4.5. the appropriate containment and disposal of the effluent water.
- 5.2.5. Various tips (nozzle) types are used when cleaning with pressurized water including:
  - 5.2.5.1. Fan tips between the approximate angles of 15 to 40 degrees may be used for general cleaning of all surfaces to remove loose surface contaminants. These tips may be used to avoid damage to relatively soft or malleable substrates.
    - 5.2.5.1.1. Common spray angles are: 0, 15, 25, and 40 degrees. Many American and European manufacturers color code tips: red (0°, yellow (15°), green (25°), and white (40°).
    - 5.2.5.1.2. As fan tips progressively decrease from 40 degrees, the impact produced is increased, which may damage softer or malleable substrates and remove more tightly bonded contaminants.
    - 5.2.5.1.3. Zero degree tips typically produce a bullet point pattern with the greatest surface impact. For effective cleaning and/or preparation, zero degree tips must only be used at distances far enough away from the surface being cleaned so that damage does not occur.
    - 5.2.5.1.4. The use of a larger tip size lowers the PSI.

- 5.2.5.2. Zero degree oscillating or spinner tips, commonly called turbo nozzles, rotate so that the cleaning is maximized. Oscillating tips combine high impact with a larger cleaning area and may commonly be used to remove loose and marginally adhered paints and coatings. These tips may be most effective on substrates that have sufficient hardness, such as concrete and steel, so that scoring and gouging damage does not occur.
- 5.2.5.2.1. Zero degree oscillating nozzles have different grades similar to the grades of sand paper grit; soft, medium, and hard, varying water impact.
- 5.2.5.2.2. Some zero degree tips have an adjustable spray angle.
- 5.2.5.3. 5.2.5.3 Hand held or walk behind surface cleaning heads may be used for cleaning horizontal or slightly sloped surfaces. These units usually contain multiple rotating tips that may be positioned close to the surface being cleaned. Surface cleaning heads may be commonly used to clean concrete, masonry, tile and roof surfaces.
- 5.2.5.4. Chemical injector tips are commonly used to apply chemical cleaners using machines equipped with downstream and nozzle chemical injection systems. These tips siphon the chemical cleaner into the water stream for application to the surface. Injector tips often have variable fans so that chemical cleaner distribution may be maximized and surface/ substrate damage may be minimized. Chemical injector tips are commonly low pressure tips.
- 5.2.5.4.1. X jet tip (Nozzle Injection System): The X-Jet is the original injector, and comes with a short range tip for close-up work. The M-5 is a variation on the original X-Jet and features a variable nozzle that allows the operator to change patterns without stopping, moving closer to, or farther away, from the surface/ substrate. The nozzle has the capability to inject and proportion strong cleaners at high or low pressure without chemically exposing the pump, hose, gun, or lance. The M-5/XJet tip propels chemicals up to 40' and holds its pattern for cleaning and rinsing.
- 5.2.5.4.2. Downstream injection system: In order for downstream injection systems to work, the pressure must be dropped at the nozzle, which creates a venturi vacuum at the chemical injector often located at the beginning of the high pressure hose. The pressure is normally dropped at the nozzle with one of the following methods:
- 1) changing the high pressure nozzle for a low pressure nozzle (normally #20 or larger, sometimes called a soap nozzle, frequently color coded black).
  - 2) using a roll over or double headed nozzle.
  - 3) using a double lance wand (sometimes referred to as variable pressure wand or a dual wand).

- 5.2.5.4.3. Double (dual) wand or variable pressure wands: This is a wand that has two lances, one high pressure nozzle, and one large low pressure nozzle, and a valve for turning the wand on and off. As the valve is opened, the pressure lowers; the dual wand on/off feature allows the pressure to be controlled at the wand. Double wands are most often used for chemical injection with a venturi feature providing pressure control at the wand.
- 5.2.6. Chemical cleaners are commonly used with pressurized water to remove various contaminants. Chemicals may be applied with special tips (described above), mixed in holding tanks/reservoirs at an appropriate concentration and pumped into the pressure washing equipment, or cleaners may be applied directly to the surface prior to washing by some other means (i.e. low pressure spray applied, brush applied or flooding). Commonly used chemical cleaners include:
  - 5.2.6.1. Sodium hypochlorite- frequently applied for removing exterior mildew and mold.
  - 5.2.6.2. Degreasers are used to remove oily contaminants including airborne pollutants and road grime.
  - 5.2.6.3. Muriatic acid- frequently applied for etching cementitious surfaces, removing efflorescence, and surface cleaning.
  - 5.2.6.4. Sodium metasilicate, a phosphate free alternative detergent which may often be applied where trisodium phosphate was formerly used.
  - 5.2.6.5. Citralic acid, which may often be used to restore the natural color to wood.
  - 5.2.6.6. Sodium carbonate- frequently applied for light or mild cleaning of wood.
  - 5.2.6.7. Sodium hydroxide- often used for heavy duty removal of wood finishes.
  - 5.2.6.8. Oxalic and citric acid, which may often be used for removing ferrous rust stains.
  - 5.2.6.9. Surfactants composed of various soaps and chemical combinations including, but not limited to the chemicals listed above.
  - 5.2.6.10. Specialized chemicals are used to remove non- visible forms of contamination such as chloride, sulfate and nitrate (CSN) soluble salts. CSN salts that are left on the surface/substrate typically cause newly applied coatings to fail by osmotic blistering.
- 5.2.7. Hot water and/or high temperature water is often employed when pressurized water is used for cleaning. On some substrates or with some contaminants, hot water may replace chemical cleaners or hot water may accentuate chemical cleaner's effectiveness including contaminate emulsification. Caution must be used on surfaces and substrates that soften when heated to avoid damage.
- 5.2.8. Silica sand, soda, or other types of abrasives, may be injected into the stream of pressurized water. The abrasive action created may be used to remove well adhered contaminants including, but not limited to graffiti. Injecting abrasives into a stream of pressurized water will increase the potential damage to existing paints and/or softer substrates.

- 5.2.9. It is not recommended to rest a tip, regardless of size, in one place since a pattern in the surface or substrate is likely to occur. A trained professional must establish a consistent motion that does not cause surface damage.
- 5.3. Performance criteria:
  - 5.3.1. Cleaning for Repainting/Restaining:
    - 5.3.1.1. The cleaned surface must be free of visible contamination such as chalk, mildew, dust, dirt, oil, grease, etc. to the level recommended by the coating manufacturer.
    - 5.3.1.2. The cleaned surface must be free of all loose substrate such as spalling concrete, rust on steel, mill scale, rotten wood etc. to the level recommended by the coating manufacturer.
    - 5.3.1.3. The cleaned surface must be free of all loose and peeling coating or any other loose detrimental foreign matter.
    - 5.3.1.4. Surface integrity must not be damaged in any way such as gouging of wood or raising of the wood grain.
  - 5.3.2. Cleaning Only:
    - 5.3.2.1. The cleaned surface must be free of visible contamination such as chalk, mildew, dust, dirt, oil, grease, etc.
    - 5.3.2.2. Some stains may be visible after cleaning is performed due to penetration into substrate. Removal of substrate to eliminate these stains is not required unless explicitly specified.
- 5.4. When details of the nine elements listed in paragraph 5.2 are not explicitly specified, then the trained professional operator is authorized to determine the combination of the nine elements to meet the desired performance criteria.
- 5.5. It is recommended that a benchmark sample(s) showing specified level of cleaning be prepared and approved according to PDCA Standard P5.
- 5.6. The acceptability of the cleaning performed shall be determined when viewed without magnification, at a distance of thirty-nine (39) inches or one (1) meter or more, under finished lighting conditions and from a normal viewing position.
- 5.7. Cleaning with pressurized water is subject to containment requirements. According to EPA and HUD regulations, the work area must be isolated so that no dust, debris, or waste water leaves the work area. Erected containments must not interfere with occupant and worker egress in an emergency. The integrity of containments must be maintained ensuring that any plastic or other impermeable materials are not torn or displaced. The appropriate containment and disposal of the effluent water shall be in accordance with the PWNA's Cosmetic Cleaning BMPs based on the EPA's Model Ordinance.
- 5.8. The contractor shall comply with all applicable OSHA and other regulations regarding the health and safety of workers. All protective equipment shall be supplied and worn as necessary.

## 6. Comments

- 6.1. Since the cost of using pressurized water to clean surfaces is greatly influenced by many factors, the specifications must clearly define project requirements and intended results.
- 6.2. This standard is a nationally recognized consensus document for the Painting and Decorating industry's work practices.

## 7. Disclaimer of Liability

- 7.1. PDCA does not warrant or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any of the information contained herein.