SSPC: The Society for Protective Coatings

SURFACE PREPARATION STANDARD SSPC-SP 16

Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

Foreword

This standard contains requirements for surface preparation of coated or uncoated metal surfaces other than carbon steel surfaces prior to the application of a protective coating system. Surface preparation using this standard is used to uniformly roughen and clean the bare substrate and to roughen the surface of intact coatings on these metals prior to coating application. Substrates that may be prepared by this method include, but are not limited to, galvanized surfaces, stainless steel, copper, aluminum, and brass. For the purpose of this standard, the zinc metal layer of hot-dip galvanized steel, rather than the underlying steel, is considered to be the substrate. This standard is intended for use by coating specifiers, applicators, inspectors, or others who may be responsible for defining a standard degree of surface cleanliness. Information about the function of brush-off blast cleaning as defined in SP 16 is in Section A1 of Appendix A.

This standard represents a degree of cleaning that is similar to that defined for carbon steel substrates in SSPC-SP 7/NACE No. 4 except that a minimum surface profile depth on the bare metal surface is required.

1. Scope

1.1 This standard defines the "Brush-Off Blast Cleaning" end condition of uncoated or coated metal surfaces other than carbon steel that have been prepared using abrasive blast cleaning techniques. The standard also includes requirements for materials and procedures necessary to achieve and verify the end condition.

1.2 Substrates that may be prepared by this method include but are not limited to: galvanized surfaces, copper and copper alloys, aluminum and aluminum alloys, and stainless steel. Sections A2 through A4 of Appendix A include special considerations for three families of alloys. Personnel performing abrasive blasting should be able to identify the alloy family from material test reports, design information, or field testing.

This standard was first developed in 2010 by the SSPC C.2.8 Committee on Surface Preparation of Non-Ferrous Metals, and was revised in 2020.

1.3 This standard includes requirements for removal of visible surface contaminants. Information on nonvisible contamination is in nonmandatory Appendix A5.

1.4 This standard provides both IEEE/ASTM[1] SI 10 International System Units (SI) units and U.S. Customary units. SI Units are presented first, with a conversion into approximate U.S. custom units shown in parentheses. The conversions are not exact; therefore, each system must be used independently of the other.

2. Definitions

2.1 A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife. Bare metal substrates shall have a minimum profile of 20 micrometers (~0.75 mil).

2.2 The entire surface shall be subjected to the abrasive blast to achieve the specified degree of cleaning and to produce a dense and uniform surface profile on the bare metal substrate. The peaks and valleys on the surface shall form a continuous pattern, leaving no smooth, unprofiled areas. Tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife.

2.3 Intact coatings that are present shall be roughened and cleaned as specified in the procurement documents. If the surface profile is not specified in the procurement documents, the abrasive selected shall roughen the cleaned surface to the degree recommended by the product data sheet for the coating to be applied. If the procurement documents and product data sheet are silent on the coating condition, the abrasive selected shall uniformly roughen the coating surface such that the gloss is noticeably reduced. See Appendix A6 for additional information about roughening intact coatings.

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, phone int+1-610-832-9500. For referenced ASTM standards, visit the ASTM website <http://www.astm.org>

2.4 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning as specified herein.

3. Additional Technical Considerations

3.1 Acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1 include variations caused by the metal composition, original surface condition, thickness of the metal, weld metal, fabrication marks, heat-treating, heat-affected zones, blasting abrasive, and differences resulting from the abrasive blast pattern.

3.2 It is possible for aggressive blast cleaning to significantly erode some alloys and soft metals (such as copper and some aluminum alloys)., Additional information on specific metals is contained in Sections A2 through A4 of Appendix A. It is also possible for aggressive abrasive blast cleaning to distort thin shapes. Additional information on potential substrate damage is contained in Sections A7 and A8 of Appendix A.

3.3 The appearance of galvanized steel, stainless steels and non-ferrous metals will differ both before and after abrasive blast cleaning. Jobsite mockups are recommended prior to commencing work. Mockups can be used to make sure all parties are in agreement with expectations prior to work taking place. Additional information is contained in Section A9 of Appendix A.

4. Referenced Standards

4.1 The latest issue, revision, or amendment of the standards listed in Sections 4.3 through 4.6 shall govern unless otherwise specified. Standards marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this standard.

4.2 If there is a conflict between the requirements of any of the cited reference documents listed in Sections 4.3, 4.4 and 4.5 and this standard, the requirements of this standard shall prevail.

4.3 SSPC STANDARDS AND JOINT STANDARDS:

	SSPC-AB 1	Mineral and Slag Abrasives
	SSPC-AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
	SSPC-AB 3	Ferrous Metallic Abrasive
	SSPC-AB 4	Recyclable Encapsulated Abrasive Media
	SSPC-SP 1	Solvent Cleaning
*	SSPC-SP 7/ NACE No. 4	Brush-Off Blast Cleaning
*	SSPC-PA 2	Determining Conformance to Dry Coating Thickness Requirements
*	SSPC-Guide 15	Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
*	SSPC-SP COM	Surface Preparation Commentary for Steel Substrates

4.4 ASTM INTERNATIONAL STANDARDS

*	ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings
*	ASTM A153A/153M	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
*	ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
*	ASTM B6	Standard Specification for Zinc
	ASTM D4285	Standard Test Method for Indicating Oil or Water in Compressed Air
	ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
*	ASTM D6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
	ASTM D7127	Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces Using a Portable Stylus Instrument
*	ASTM F21	Standard Test Method for Hydrophobic Surface Films by the Atomizer Test
*	ASTM F22	Standard Test Method for Hydrophobic Surface Films by the Water-Break Test (West Conshohocken, PA: ASTM International)

4.5 NACE INTERNATIONAL STANDARD[2]

	SP0178	Design, Fabrication and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service

4.6 U.S. CODE OF FEDERAL REGULATIONS[3]

*	Title 29 Part 1926.62	Lead
*	Title 29 Part 1926.1126	Chromium VI

[2] NACE International, 15835 Park Ten Place, Houston, Texas 77084, USA, Phone: +1-281-228-6200

[3] CFRs may be obtained online at https://www.ecfr.gov/

5. Procedures Before Brush-Off Blast Cleaning of Non-Ferrous Metal Surfaces

5.1 Before blast cleaning of non-ferrous metal surfaces, visible deposits of oil, grease, or other contaminants that would interfere with coating adhesion shall be removed in accordance with SSPC-SP 1 or other specified methods. Section A5 of Appendix A provides information about nonvisible contaminants.

5.2 Surface imperfections shall be corrected to the extent specified in the procurement documents (project specifications). Additional information on surface imperfections is in Section A10 of Appendix A.

5.3 Unique Requirements for Preparation of Galvanized Steel

5.3.1 Before blast cleaning, galvanized surfaces shall be checked for the presence of "wet storage stain." Blast cleaning shall not be used to remove wet storage stain. The "dwell time" necessary for the blast stream to remove wet storage stain can damage the galvanized surface. Additional information on the removal of wet storage stain is in Section A11 of Appendix A. Additional information on blast cleaning of galvanized steel is in Section A12 of Appendix A.

5.3.2 Unless written documentation exists to confirm that a galvanized surface is known to be free of chromates or other passivating treatments, representative areas of galvanized surfaces that will be coated shall be tested as described in Section 5.3.3 for the presence of chromates or other passivating treatments before brush-off blast cleaning is performed. If chromates or other passivating treatments are detected, the surface shall be retested after blast cleaning to confirm complete removal. Observe applicable OSHA requirements for worker protection from toxic metals. Additional information on heavy metal toxicity is in Section A13 of Appendix A.

5.3.3 Test for Presence of Passivating Treatments on Galvanizing (e.g., Chromating): "Chromating" refers to the treatment of galvanized parts to prevent the occurrence of wet storage stain. Most sheet metal and coil stock used to fabricate decking and curtain wall receives chromating treatments. The presence of chromates or other passivating treatments is detected by using a solution of copper sulfate, with the following procedure:

- Ensure that surfaces are free of any visible oxidation or oxidation by-products.
- Prepare the solution by dissolving 2 grams of copper sulfate crystals in 100 ml of deionized water.
- Mark off three adjacent areas on the galvanized part, approximately 6.5 cm^2 (1 in^2).
- Leave one area untouched, solvent wash the second and third areas, and also thoroughly sand the third area using emery paper.
- Using an eyedropper or pipette, saturate a cotton swab with the copper sulfate solution and apply to all three areas, or apply the solution directly to the three areas.

If all three areas turn black immediately, there is no passivation on the surface. If the first area does not turn black within 10 seconds and the second and third areas turn black immediately, there is no passivation on the surface with the possible exception of light oil. If the first and second areas do not turn black within 10 seconds and the third area turns immediately, a passivator of some type is present.

6. Abrasive Blast Cleaning Methods and Operation

6.1 Any of the following methods of surface preparation can be used to brush-off blast clean a non-ferrous metal substrate. Hazardous materials may be present. Section A14 of Appendix A provides additional information regarding hazardous materials.

6.1.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

6.1.2 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

6.1.3 Other methods of surface preparation may be used to brush-off blast clean non-ferrous metal surfaces if specified in the contract documents. Additional information on cleaning soft and thin substrates is in Sections A7 and A8 of Appendix A. Additional information on the use of wet abrasive blast cleaning to clean galvanized surfaces is in Section A12.3 of Appendix A.

6.2 Clean, dry compressed air shall be used for nozzle blasting. Cleanliness of the compressed air shall be verified in accordance with the procedure described in ASTM D4285. Moisture separators, oil separators, traps, or other equipment are often necessary to achieve this requirement.

7. Abrasives for Brush-Off Blast Cleaning of Non-Ferrous Metal Substrates

7.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the surface to be cleaned, the type of blast cleaning system used, the finished surface to be produced (cleanliness and surface profile [roughness]), and whether the abrasive will be recycled. With the exception of stainless steel, this standard does not permit use of ferrous abrasive media (e.g., carbon steel grit, carbon steel shot, steel slag, and chilled iron abrasives) unless otherwise specified. Explanation is provided in Appendices A2, A3 and A4. Appendix A15 contains additional information on abrasive selection.

7.2 Mineral and slag abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1 or as required by the procurement documents (project specification). The cleanliness and size of the work mix for recycled non-metallic abrasives shall be maintained to ensure compliance with Section 4.4 (Quality Control Tests for Recycled Work Mix) of SSPC AB-1.

7.3 New stainless-steel blast cleaning abrasives shall meet the SSPC-AB 3 requirements for Water Soluble Contaminants (Section 4.1.4), Moisture Content (Section 4.1.5), and Oil Content (Section 4.1.6) unless otherwise required by the procurement documents (project specification). The cleanliness and size of the work mix for recycled stainless-steel abrasive shall comply with all requirements of SSPC-AB 2 Section 4.

7.4 Recyclable encapsulated abrasive media shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 4 or as required by the procurement documents (project specification). Encapsulated media containing carbon steel shall not be used unless permitted by the procurement documents. The cleanliness and size of the work mix for recycled non-metallic abrasives shall be maintained to ensure compliance with Section 4.4 (Quality Control Tests for Recycled Work Mix) of SSPC AB-4.

7.5 The abrasive shall comply with any limitations or special requirements stipulated by the procurement documents. Abrasive embedment and abrasives containing contaminants are not acceptable for some substrates and service requirements.

7.6 The abrasive material shall produce a dense and uniform profile acceptable for application of the intended coating. After cleaning, the cleaned metal surface shall have a minimum 20-micrometer (~0.75 mil) profile, measured in accordance with ASTM D4417 or ASTM D7127. If present, intact tightly adherent coating shall be roughened as specified in the procurement documents (project specification). If the surface profile is not specified in the procurement documents, the abrasive selected shall roughen the cleaned surface to the degree required by the product data sheet for the coating to be applied.

8. Procedures Following Brush-Off Blast Cleaning and Immediately Prior to Coating

8.1 Visible deposits of oil, grease, or other contaminants shall be removed by methods in accordance with SSPC-SP 1, or as specified. Note that some cleaning methods specified in SSPC-SP 1 may not be compatible with all metals. See Sections A2 through A4 of Appendix A for additional information on cleaning specific substrates.

8.2 Dust, dirt, and loose residues shall be removed from prepared surfaces by brushing; blowing off with clean, dry air; vacuum cleaning; or other specified methods.

8.3 Cleanliness of the compressed air must be verified in accordance with the procedure described in ASTM D4285.

8.4 Removal of chromates or other passivating treatments detected on galvanized surfaces (see Section 4.3.2) shall be confirmed before coating application, using the procedure in Section 4.3.3.

8.5 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified in this standard.

9. Disclaimer

9.1 This is a consensus standard developed by SSPC: The Society for Protective Coatings. While every precaution is taken to ensure that all information furnished in SSPC standards and specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, coatings, or methods specified herein, or of the specification or standard itself.

9.2 This standard does not attempt to address all problems concerning safety and health associated with its use. The user of this standard, as well as the user of all products or practices described herein, is responsible for instituting appropriate health and safety practices and for ensuring compliance with all governmental regulations.

Nonmandatory Appendix A: Explanatory Notes

A1 FUNCTION: This standard provides a degree of cleaning for non-ferrous metal substrates comparable to or greater than brush-off blast cleaning (SSPC-SP 7/NACE No. 4) of carbon steel. It is used to clean and roughen coated and uncoated metal surfaces (other than carbon steel), typically associated with the application of a protective coating system. The primary functions of brush-off blast cleaning of non-ferrous metal substrates before coating are (a) to remove material from the surface that can cause early failure of the coating and (b) to obtain a suitable surface profile (roughness) to enhance the adhesion of the new coating system.

A2 ALUMINUM ALLOYS: Aluminum alloys are widely used in engineering structures and components where light weight or corrosion resistance is required. The typical alloying elements are copper, magnesium, manganese, silicon, tin, and zinc. Aluminum alloy surfaces will develop a protective layer of aluminum oxide unless protected by anodizing or correct painting procedures. Galvanic corrosion can occur when an aluminum alloy is placed in electrical

contact with other metals with more positive corrosion potentials than aluminum, and an electrolyte is present that allows ion exchange. Aluminum alloys are softer and more chemically reactive than steel.

To avoid damaging the substrate, special precautions should be exercised when preparing an aluminum surface for painting. Chipping hammers and scrapers tend to gouge aluminum. Stainless-steel wire brushes, non-metallic abrasive paper, and aluminum wool are suitable for cleaning aluminum surfaces. Some aluminum alloys may work harden during abrasive blasting.

Abrasive blast cleaning can be performed on aluminum if the abrasive and blasting pressures are chosen correctly. Common abrasives specified in Section 7 include aluminum oxide (alumina, corundum, or emery), garnet, stainless-steel grit or shot, and encapsulated abrasive media (sponges). Excessive abrasive blasting may work-harden some aluminum alloys.

In some cases, abrasive blasting may be performed for aesthetic purposes (e.g., for cleaning or to create a uniform appearance) without any intention of applying a coating; such applications are beyond the scope of this standard. Media for these applications includes plastic pellets, agricultural abrasives (corn cobs, walnut shells, peach pits), glass beads, sodium bicarbonate (baking soda), and carbon dioxide (dry ice). Since these media will not generate a significant surface profile, they are not included in Section 7 of this standard.

Because aluminum is relatively active on the galvanic scale, care should be taken to avoid using surface preparation media and tools which may contaminate or embed more noble materials such as steel or copper on the surface. Carbon steel wire brushes, copper wire brushes, steel wool, brass wool, and steel grit/shot should be avoided. Abrasive mats, paper, and cloths can be used to remove corrosion products or to feather the edges of intact paint. However, these materials may contaminate the aluminum if they were previously used on another type of surface. For example, steel particles entrapped in abrasive paper could be ground into an aluminum surface, possibly creating an unfavorable galvanic couple.

Chemical cleaning has been used on aluminum in situations where blasting is not feasible, though it will not produce a surface profile. Chemical pretreatments are designed to chemically alter aluminum surfaces in order to promote paint adhesion. Use of these products is outside the scope of this standard, except to the extent that abrasive blasting may be performed in conjunction with these chemical techniques.

A3 STAINLESS STEEL: Stainless steel refers to a family of ferrous alloys containing a minimum of 10.5% chromium. Alloys containing this minimum amount of chromium tend to form a passive chromium-rich oxide in oxidizing environments. This passive film provides the stainless-steel class of alloys their characteristic resistance to corrosion. The stability of the oxide layer depends on the alloy composition, surface treatment, and environment. Stainless steels can be classified into five categories: austenitic, ferritic, duplex, martensitic, and precipitation hardening. Each category exhibits characteristically different properties (e.g., corrosion resistance, ductility, tensile strength, weldability).

Commonly-used abrasives include hard, non-metallic abrasive (e.g., aluminum oxide or garnet) and stainless-steel grit or shot. Care should be taken to avoid contaminating the stainless steel with carbon steel or iron. Carbon steel shot and grit should be avoided as they may contaminate the surface, causing significant pitting or rust spots. Some owners may choose to accept this risk for preparation of ferritic stainless steels or in situations where stainless steel is incidental to a larger, low alloy steel surface. Excessive abrasive blasting may work-harden some stainless-steel alloys.

In some cases, abrasive blasting may be performed for aesthetic purposes (e.g., cleaning or to create a uniform appearance) without any intention of applying a coating; such applications are beyond the scope of this standard. Media for these applications includes encapsulated abrasive media (sponges), plastic pellets, agricultural abrasives (corn cobs, walnut shells, peach pits), glass beads, sodium bicarbonate (baking soda), and carbon dioxide (dry ice). Since these media will not generate a significant surface profile, they are not included in Section 7 of this standard.

Chemical cleaning has been used on stainless steels in situations where blasting is not feasible, though it will not produce a surface profile. Chemical pretreatments are designed to chemically alter the surface to promote paint adhesion. Use of these products is outside the scope of this standard, except to the extent that abrasive blasting may be performed in conjunction with these chemical techniques.

A4 COPPER ALLOYS: Copper alloys include a wide variety of materials with a high resistance to corrosion as well as other desirable engineering properties. Bright copper surfaces tarnish as they oxidize; this tarnish may eventually become dark brown, black, or green. Copper alloys include brasses, bronzes, and copper nickels as well as other alloys. Copper alloy applications include pipes, valves, pumps, strainers, heat exchangers, roofing clads, and statues.

Copper alloys have varying hardness; thus, the required abrasive blasting parameters to achieve a given profile will vary by specific alloy. Common abrasives include mineral abrasives (aluminum oxide, garnet), stainless steel grit/shot, and encapsulated abrasive media (sponges). Care should be taken to avoid contaminating copper alloys with carbon steel or iron. Hence, carbon steel shot and grit should not be used on copper alloys.

In some cases, abrasive blasting may be performed for aesthetic purposes (e.g., cleaning or to create a uniform appearance) without any intention of applying a coating; such applications are beyond the scope of this standard. Media for these applications includes plastic pellets, agricultural abrasives (corn cobs, walnut shells, peach pits), glass beads, sodium bicarbonate (baking soda), and carbon

dioxide (dry ice). Since these media will not generate a significant surface profile, they are not included in Section 7 of this standard.

Copper alloys are often simply hand or power tool sanded using abrasive cloths, belts, or pads. Ultrahigh-pressure waterjet cleaning is used in conservation of copper, bronze, and softer alloy structures. Laser removal is becoming more accepted by conservation and preservation professionals. These procedures are beyond the scope of this standard.

A5 NONVISIBLE CONTAMINATION (NV): Nonvisible contamination is the presence of organic matter (e.g., thin films of oil and grease), inorganic matter, or soluble ionic materials (e.g., chlorides, salts, nitrates, and sulfates) that may be present on the substrate. These materials should be removed, as described below, prior to any coating application.

A5.1 Metals contaminated with water-soluble salts (e.g., sodium chloride and potassium sulfate) rapidly form oxides on the metal surface. Formation of this oxide layer can be minimized by removing these salts from the substrate surface and eliminating sources of recontamination during and after cleaning. These contaminants, along with their concentrations, may be identified using laboratory and field tests as described in SSPC-Guide 15.

A5.1.1 The level of nonvisible, water soluble ionic contaminants found in an extraction from the surface that may remain on the surface is usually expressed as mass per unit area; for example, $\mu g/cm^2$ or mg/m^2 (1 $\mu g/cm^2$ = 10 mg/m^2).

A5.1.2 The following is an example specification for salt contamination based on concentration measurements:

"Immediately prior to the application of the coating, the surface extract shall not contain more than *[xx]* $\mu g/cm^2$ of [*specify the specific contaminant (e.g., chloride)]* when tested with *[specify the method.]*"

A5.1.3 The following is an example specification for salt contamination based on conductivity measurements:

"Immediately prior to the application of the coating, the conductivity of the surface extract shall not exceed *[xx]* $\mu S/cm$ when tested with *[specify the method.]*"

A5.2 Hydrophobic nonvisible contaminants (e.g., oil, silicone, wax) may have an effect on coating performance. Coating manufacturers should be consulted for recommendations of maximum surface contamination allowed.

A5.2.1 ASTM F22, "Standard Test Method for Hydrophobic Surface Films by the Water-Break Test," or ASTM F21, "Standard Test Method for Hydrophobic Surface Films by the Atomizer Test" can be used to determine the presence of non-visible hydrophobic material (e.g., hydrocarbons and other organic contaminants) on the surface. Ultraviolet ("black") light can be used to detect hydrocarbon films on the surface, though some oils may not fluoresce. Appropriate eye protection should be worn when using ultraviolet light to inspect surfaces

A5.3 The specifier should determine what level of nonvisible contaminants may remain. The test method or procedure to be used for determining the level of remaining nonvisible contaminants should be addressed in the procurement documents (project specification).

A6 ROUGHENING OF INTACT COATING: The purpose of roughening the intact coating is to enhance the adhesion of the subsequent coating. When the surface is roughened, the gloss will typically be reduced.

A7 EROSION OF SOFT METAL SUBSTRATES: When performing brush-off abrasive blast cleaning of soft metals such as zinc (galvanizing), copper, brass, and some aluminum alloys, care should be taken to avoid erosion of the metal substrate. Techniques that may reduce the risk of erosion include use of softer abrasive media, lower nozzle pressures and increased stand-off distances.

A8 DEFORMATION OF THIN METAL SUBSTRATES: Care should be taken to ensure that thin metals do not deform during brush-off blast cleaning. Techniques that may prevent deformation include reducing the blast pressure, using a less aggressive (i.e., softer, or finer) abrasive, and moving the blast nozzle rapidly across the surface being roughened and cleaned.

A9 JOB MOCK-UP: If the owner wants to require a job mock-up, the following language may be used:

> "The contractor shall prepare a sample area to serve as a mock-up for the degree of surface preparation. The sample area shall be representative of the surface to be cleaned. The sample area shall be either a separate specimen or a designated portion of the actual surface. Following acceptance by the contracting parties, the mock-up shall be documented, preserved, or both, to serve as a reference for the execution of the project, and all documentation shall be retained as part of the project records. In any dispute, the written definition set forth in this standard shall take precedence over the mock-up or other visual comparators."

A10 SURFACE IMPERFECTIONS: Surface imperfections that may cause premature coating failure include sharp edges and projections, crevices, weld porosities, and laminations. Many coatings tend to pull back from sharp features and tend not to fully wet crevices and deep pores, rendering these types of areas difficult to properly coat and protect.

A10.1 Poorly adhering fabrication defects, such as weld slag residues, loose weld spatter, and casting defects may be removed during the blast cleaning operation. Other surface defects such as weld porosities or deep corrosion pits may not be evident until the surface preparation has been completed. Therefore, the timing of the repairs may occur before, during, or after the blast cleaning operation. Consideration should be given to proper planning for such surface repair work. The SSPC-SP COM and NACE SP0178 contain additional information on surface imperfections.

A10.2 The cost of the methods to remedy surface imperfections (e.g., edge rounding and weld spatter removal) should be compared with the benefits of preventing premature coating failure. Those responsible for establishing the requirements and those responsible for performing the work should agree on the procedures to be used to repair surface imperfections to the extent required in the procurement documents (project specification).

A11 WET STORAGE STAIN: Wet storage stain is the whitish zinc corrosion product that forms when galvanized parts are exposed to moist air without sufficient air circulation between the parts. Wet storage stain will reduce the adhesion of subsequently applied coatings, possibly resulting in coating delamination. Using a nylon brush and rinsing with water may remove light cases of wet storage stain. More severe cases with thick deposits may be removed by brushing with a dilute solution of acetic or citric acid. Surface contact time should be less than four minutes. Lime juice and white vinegar have been found to be effective cleaners. ( ) Immediately after brushing, the cleaned areas should be rinsed with a large amount of water. After galvanized steel is rinsed, it is desirable to allow the part to fully dry prior to surface roughening. Heated drying can be used to accelerate the complete removal of water from the surface.

A12 BRUSH-OFF BLAST CLEANING GALVANIZED STEEL

A12.1 Thickness of Zinc on Galvanized Steel: The zinc layers should remain intact during brush-off blast cleaning. It is recommended that the thickness of new galvanizing be measured before and after brush-off blast cleaning using measurement techniques described in SSPC-PA 2 to confirm that it still conforms to ASTM A123 or ASTM A153A/153M, as applicable. Any areas with insufficient thickness should be repaired in accordance with ASTM A780.

A12.1.1 Brush-off blast cleaning of simple shapes of galvanized steel may result in removal of an unacceptable amount of the galvanized layer. This effect may be exacerbated on complicated shapes. A mock-up or test area should be abrasive blasted to determine if excessive zinc is being removed. If this is the case, consideration should be given to replacing the zinc (e.g. spot applications of an organic zinc-rich primer) or alternative measures of surface preparation such as zinc phosphate treatment may be used. These methods are beyond the scope of this standard.

A12.2 Zinc Oxides: Newly exposed zinc surfaces will oxidize rapidly, especially in the presence of moisture. During brush-off blast cleaning and subsequent painting of galvanized steel, the surface temperature should be a minimum of 3 °C (5 °F) above the dew point, in order to retard the formation of zinc oxides. To limit the amount of zinc oxide on the cleaned surface, galvanizing should not be permitted to get damp after cleaning and should be painted as soon as possible within the same work shift that the surfaces were cleaned.

A12.3 On galvanized steel surfaces, the use of wet abrasive blast cleaning can result in rapid formation of oxides and hydroxides. Additional information on the preparation of galvanized steel for painting can be found in ASTM D6386.

A13 TOXICITY: The presence of toxic substances in the abrasive or material being removed may place restrictions on the methods of cleaning permitted. If chromates are present, requirements of 29 CFR 1926.1126 hexavalent chromium [chromium VI]) for worker protection may apply. ASTM B6 lists five grades of zinc containing various levels of lead ranging from 0.003% to 1.4%. Depending on the grade of zinc used by the galvanizer, abrasive blast cleaning of the galvanized surface may also require compliance with Code of Federal Regulations, Title 29 part 1926.62 (Lead).

A14 HAZARDOUS MATERIAL: The presence of hazardous material in the coatings, cleaning media, or in the work area itself can place restrictions on the methods of cleaning permitted. Abrasive blast cleaning is often used to remove coatings with hazardous components. Applicable industrial hygiene tests should be performed. Good industrial hygiene should be followed.

A15 ABRASIVE SELECTION: The selection of the size and type of abrasive that will most effectively and economically produce the desired surface finish is not an exact science because of the many variables involved. A detailed discussion on selection of abrasives is contained in SSPC-SP COM. Following are important considerations when abrasive blasting non-ferrous metals and stainless steels.

A15.1 Abrasive Size, Hardness, and Density: Non-ferrous metals and stainless steels encompass a wide range of material properties (e.g., hardness). Much of the guidance in SSPC-SP COM pertains to steel substrates. Other things being equal, deeper profile will be obtained on softer alloys and shallower profile will be obtained on harder alloys. Finer, softer, or less dense abrasives should be considered for softer alloys. Sections A2 through A4 contain further guidance.

Finer, softer, or less dense abrasives may be used to prevent deformation of thin sheets of metal during blast cleaning. Some materials that have been found to be suitable include aluminum/magnesium silicate, soft mineral sands, soft crushed glass and glass bead media, and organic media such as corncobs or walnut shells. Note that some of these abrasives may not impart the required surface profile.

A15.2 Air Pressure: Relatively low nozzle pressures (e.g., 0.45 MPa [~65 psi]) may be used when abrasive blasting softer materials to reduce the risk of damage to the substrate.

A15.3 Embedment: Blasting abrasives may become embedded in, or leave residues on, the surface of the metal during cleaning. Some abrasives are galvanically incompatible with some non-ferrous metals and stainless steels. For example, embedded steel (e.g., from chilled iron grit, steel shot, steel grit) will cause aluminum to galvanically corrode. On the other hand, in a copper alloy the embedded steel will galvanically corrode. To reduce the risk of coating failure or other concerns, carbon steel and chilled iron abrasives (including steel shot, steel slag, and any other ferrous abrasives) should not be used on non-ferrous substrates, or when chemistry of the embedded abrasive could cause halogen-induced stress corrosion cracking or liquid metal embrittlement.

Non-metallic or mineral abrasives may also embed in blast cleaned surfaces. Embedded mineral abrasive may result in a blasted surface that does not meet the visual cleanliness criteria. Adjusting abrasive blasting materials, parameters, or both, may help to reduce embedment

Abrasive material may also transfer contaminants to the surface being abrasively blasted. Care should be taken to ensure that the abrasive is free from detrimental amounts of water-soluble, solvent-soluble, acid-soluble, or other soluble contaminants (particularly if the cleaned metal is to be used in a semi-wet or immersion environment). Criteria for selecting and evaluating abrasives are in SSPC-AB 1.