

SSPC: The Society for Protective Coatings

SURFACE PREPARATION STANDARD NO. 17

Thorough Abrasive Blast Cleaning of Non-Ferrous Metals

Foreword

This standard contains requirements for thorough abrasive blast cleaning of coated or uncoated metal surfaces other than carbon steel prior to the application of a protective coating system. This standard is used when the objective is to remove all visible contaminants from the surface and allows random color variation on no more than 5% of each unit area of surface. Surface preparation using this standard is used to provide a greater degree of cleaning than brush-off blast cleaning of stainless steels and non-ferrous metals (SSPC-SP 16). This standard represents a degree of cleaning that is similar to that defined for carbon steel substrates in SSPC-SP10/NACE No. 2.

In this standard, the terms *shall* and *must* are used to state mandatory requirements. The term *should* is used to state something considered good and recommended but not mandatory. The term *may* is used to state something considered optional.

1. Scope

1.1 This standard defines the “Thorough Abrasive Blast Cleaning” level of surface cleanliness achieved using abrasive blast cleaning on uncoated or coated non-ferrous or stainless-steel surfaces. The standard also includes requirements for materials and procedures used to achieve and verify the cleanliness level. This standard is for the preparation of non-ferrous metals for coating application and should not be used for carbon steel substrates. The primary functions of blast cleaning before coating are:

- (a) To remove material from the surface that can cause premature failure of the coating system; and
- (b) To obtain a suitable surface profile (roughness) to enhance the adhesion of the new coating system.

1.2 Substrates that may be prepared by this method include but are not limited to: copper and copper alloys, aluminum and aluminum alloys, and stainless steel. Sections A1 through A3 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 developed by the SSPC C 2 20 Abrasive Blast Cleaning of Non-Ferrous Metals Committee was first issued in September 2019

1.3 Because of the possible variations in the appearance of substrates covered by this standard, the contractor is required to prepare a sample area to serve as a Job Reference Standard (JRS) for the degree of surface preparation. Section 3.3 describes this requirement in more detail.

1.4 This standard is limited to requirements for visible surface contaminants. Information on nonvisible contamination is in Section A4 of nonmandatory Appendix A.

1.5 Information about the use of this standard in maintenance coating work is in Section A5 of Appendix A.

1.6 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 Thorough Abrasive Blast Cleaned Surface:

A thorough abrasive blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, oxides (corrosion products), coating, and other foreign matter. Random color variations shall be limited to no more than 5% of each unit area of surface (approximately [~] 5,800 mm² [9.0 in²] (i.e., a square 76 mm x 76 mm [3.0 in x 3.0 in]), and may consist of light shadows, slight streaks, or minor discolorations. Section A6 of Appendix A provides additional information about color variation. Section A7 of Appendix A provides an example of a specification statement.

2.2 The entire metal surface shall be subjected to the abrasive blast to achieve the specified degree of cleaning and to produce a dense and uniform surface profile (e.g., depth and texture) on the bare metal substrate. The peaks and valleys on the surface shall form a continuous pattern, leaving no smooth, unprofiled areas.

2.3 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning as specified herein. Section A8 of Appendix A provides additional information regarding time from blast until coating application.

⁽¹⁾ IEEE/AS M S 10, American National Standard or Metric Practice, AS M international, West Conshohocken, PA, 2017, <<https://www.astm.org>>

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(s), 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 A1 through A3 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 A9 and A10 of Appendix A.

3.3 The contractor shall prepare a sample area to serve as a Job Reference Standard (JRS) 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 JRS 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 JRS or other visual comparators.

4. Referenced Documents.

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 standards listed in Sections 4.3 through 4.6 and this standard, the requirements of this standard shall prevail.

4.3 SSPC Standards, Guides and Publications

SSPC-SP 1	Sovent Cleaning
SSPC-SP 16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
SSPC-AB 1	Mineral and Sag Abrasives
SSPC-AB 2	Cleanliness of Recycled Ferrous Metal Abrasives
SSPC-AB 4	Recyclable Encapsulated Abrasive Media (in a compressed carrier matrix)

*	SSPC-PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
	SSPC-PA 17	Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
*	SSPC-PA Guide 4	Guide to Maintenance Repairing with Organic and Aqueous Painting Systems
*	SSPC-Guide 15	Field Methods for Reevaluation and Analysis of Substrates on Steel and Other Nonporous Substrates
*	SSPC-SP COM	Surface Preparation Commentary for Steel Substrates

4.4 ASTM International Standards

	ASTM D4285	Method for Determining Presence of Oil or Water in Compressed Air
*	ASTM D4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
*	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

4.5 NACE International Standard ⁽²⁾

*	SP 0178	Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service
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4.6 Federal Standards⁽³⁾

A-A-59316	Commercial Item Description – Abrasive Materials; for Blast Cleaning
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5. Procedures Before Abrasive Blast Cleaning

5.1 Pre-cleaning: Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1 or other agreed-upon methods. Section A4 of Appendix A provides information about nonvisible contaminants.

5.2 Before beginning cleaning, surface imperfections such as sharp edges or weld spatter shall be removed from the surface to the extent required by the procurement documents (project specification). Section A11 of Appendix A provides additional information.

6. Abrasive Blast Cleaning Methods and Operation

6.1 Any of the following methods of surface preparation can be used to achieve a thorough abrasive blast-cleaned

⁽²⁾ NACE International, 15835 Park Ten Place, Houston, TX 77084-5145 Phone +1 (281) 28-6200 Standards available from <<https://www.nace.org>>

⁽³⁾ General Services Administration, <http://quicksearch.dla.mil/qsSearch.aspx>

non-ferrous metal or stainless-steel surface. Hazardous materials may be present. Section A12 of Appendix A provides additional information regarding hazardous materials.

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

6.1.2 Dry abrasive blast cleaning 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 Dry abrasive blast cleaning using a closed-cycle, recirculating abrasive system with centrifugal wheels and abrasive.

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 may be necessary to achieve this requirement.

6.3 Wet abrasive blast cleaning methods may be used to achieve a thorough abrasive blast cleaned non-ferrous metal or stainless-steel surface if specified in the contract documents. Information on the use of inhibitors to prevent the formation of corrosion immediately after wet abrasive blast cleaning is in Section A13 of Appendix A.

6.4 Additional considerations when performing thorough abrasive blast cleaning of non-ferrous metals or stainless steels should be considered and are found in Section A1 through Section A3 of Appendix A.

7. Blast Cleaning Abrasives

7.1 Selection of abrasive size and type shall be based on the type, grade, thickness, and surface condition of the non-ferrous metal or stainless steel 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.

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 Aluminum oxide shall comply with A-A-59316 Type I, Grade A, or SSPC-AB 1.

7.4 New stainless-steel blast cleaning abrasives shall meet the SSPC-AB 1 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. See Appendix A 14 for additional information on use of other ferrous media.

7.5 If encapsulated abrasive is used, cleanliness and size shall meet the requirements of Section 6 of SSPC-AB 4.

7.6 The abrasive shall comply with any additional specified requirements or limitations. Additional information on abrasive selection for thorough abrasive blast cleaning of non-ferrous metals and stainless steels is found in Section A15 of Appendix A.

7.7 After cleaning, the surface profile of the cleaned metal, when measured in accordance with SSPC-PA 17, shall conform to the requirements 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. Additional information on surface profile and the film thickness of coating applied over the surface profile is in Sections A16 and A17 of Appendix A.

8. Procedures Following Blast Cleaning and Immediately Prior to Coating

8.1 Visible deposits of oil, grease, and other soluble contaminants shall be removed by methods in accordance with SSPC-SP 1 or as specified.

8.1.1 Note that some cleaning methods specified in SSPC-SP 1 may not be compatible with all metals. See Sections A1 through A3 of Appendix A for additional information on specific materials.

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

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

8.3 After blast cleaning, any surface imperfections (e.g., sharp edges, weld spatter) shall be removed or resolved to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal or resolution of surface imperfections shall be corrected to meet the requirements of Section 7.7. After removal of surface imperfections, the surface shall be blast cleaned again to meet the profile requirements of the procurement documents (project specification). Additional information on surface imperfections is provided in Section A11 of Appendix A.

8.4 Immediately prior to coating application, the entire surface to be coated shall comply with the degree of cleanliness defined by this standard. Any visible oxide that forms on the surface of the metal after blast cleaning shall be removed to meet the requirements of this standard before coating. Information on contamination, overcoat window, and the effect of dew point (surface condensation) is provided in Sections A4, A8 and A18 of Appendix A.

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 appropriate governmental regulations.

Appendix: Explanatory Notes (Nonmandatory)

This appendix is considered nonmandatory, although it may contain mandatory language. It is intended to provide supplementary information or guidance only. The user of this standard is not required to follow, but may choose to follow, any or all the provisions herein.

A1 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.

A1.1 Special precautions should be exercised when preparing an aluminum surface for painting to avoid damaging the substrate. 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.

A1.2 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.

A1.3 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.

A1.4 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 or 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.

A1.5 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.

A2 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).

A2.1 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.

A2.2 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.

A2.3 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.

A3 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.

A3.1 Copper alloys vary in 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, or a mix of steel and shot, and encapsulated abrasive media. 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.

A3.2 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.

A3.3 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.

A4 NONVISIBLE CONTAMINATION (NV): Undesirable material on a substrate, often present in a very thin film that cannot be detected using only normal (or corrected normal) vision. The film may include (singly or in combination) oil, grease, soluble ionic materials (e.g., chlorides, salts, nitrates, and sulfates), and other undesirable organic or inorganic materials. Nonvisible contamination should be removed, as described below, prior to any coating application.

A4.1 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.

A4.1.1 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, $\mu\text{g}/\text{cm}^2$ or mg/m^2 ($1 \mu\text{g}/\text{cm}^2 = 10 \text{ mg}/\text{m}^2$).

A4.1.2 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] $\mu\text{g}/\text{cm}^2$ of [the specific contaminant (e.g., chloride)] when tested with [a specified method]."

A4.1.3 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] $\mu\text{S}/\text{cm}$ when tested with [a specified method]."

A4.2 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.

A4.2.1 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

A4.3 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).

A5 MAINTENANCE COATING WORK: When this standard is used in maintenance coating work, specific instructions should be provided on the extent of the surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the surface cleanliness should be achieved across the entire area specified. For example, if all weld seams are to be cleaned in a maintenance operation, the degree of surface cleanliness applies to 100 percent of all weld seams. If the entire structure is to be cleaned, this degree of surface cleanliness applies to 100 percent of the entire structure. SSPC-PA Guide 4 provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

A6 COLOR VARIATIONS: Non-ferrous metals and stainless steels will exhibit color variations after the abrasive blasting process. If excessive (i.e., greater than 5%) color variations are still present after thorough abrasive blast cleaning, they should be removed by repeat abrasive blast cleaning, if necessary, to meet the requirements of this standard and to provide the desired profile. Section 3.1 lists acceptable variations in appearance that do not affect surface cleanliness as defined in Section 2.1. When preparing the JRS required by Section 3.3, consideration should be given to the appearance of color variations for the specific surface being prepared.

A7 SPECIFICATION STATEMENT:

A7.1 The following is an example of a specification statement:

"All surfaces to be coated shall be cleaned in accordance with the procedures in SSPC-SP XX and shall meet the requirements of SSPC-SP XX immediately prior to coating application."

A7.2 In addition, the specifier should consider whether a surface should be cleaned as required to achieve a specified maximum level of nonvisible contamination (NV) prior to recoating. Suggested specification statements for NV are given in Sections A4.1.2 and A4.1.3.

A8 TIME FROM BLAST TO FIRST COAT: The longer an abrasive blast cleaned surface remains uncoated, the greater the risk for nonvisible contamination (see Section A4) and formation of surface oxides detrimental to coating adhesion/performance. Non-ferrous metals and many stainless steels do not "rust-back" visually like carbon steel surfaces, but they oxidize, nonetheless. Because there are no obvious visual indications of oxidation, it is good practice to apply the first coat to a non-ferrous or stainless-steel substrate as soon as possible after abrasive blasting, or as specified in the procurement documents. If the coating window is not met, re-inspection for contamination and oxidation should be performed (see Section 8.4). Because oxidation is difficult to see, it may be helpful to abrasive blast a small area for comparison to the aged surfaces.

A9 EROSION OF SOFT METAL SUBSTRATES: When performing thorough abrasive blast cleaning of soft metals such as 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 lower nozzle pressures and increased stand-off distances. If removing intact coating, a higher nozzle pressure and a closer stand-off distance may be required to remove the coating, but once the coating is removed the nozzle pressure may be reduced, the stand-off distance increased, or both.

A10 DEFORMATION OF THIN METAL SUBSTRATES: Care should be taken to ensure that thin metals do not deform during thorough abrasive blast cleaning. Techniques that may prevent deformation including reducing the blast pressure, using a less aggressive (i.e., softer, or finer) abrasive, moving the blast nozzle rapidly across the surface being roughened and cleaned, or both. The procurement documents may specify a lower surface profile for thin shapes where deformation is a concern.

A11 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.

A11.1 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.

A11.2 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).

A12 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.

A13 WET ABRASIVE BLAST CLEANING: The process of wet abrasive blast cleaning may leave behind debris that can cause corrosion on a substrate. Surface preparation water should be used for rinsing.⁽⁴⁾ It may be necessary to add inhibitors to the water or apply them to the surface immediately after blast cleaning to temporarily protect the surfaces from corrosion. The use of inhibitors or the application of coating over slight discoloration should be in accordance with the requirements of the coating manufacturer. Caution: Some inhibitive treatments may interfere with the performance of certain coating systems.

A14 FERROUS ABRASIVE MEDIA: Ferrous abrasive media (including, but not limited to, steel shot, steel grit, carbon steel, and chilled iron abrasives) is not permitted in this standard for reasons discussed in A1, A2 and A3. In some situations, and owner may accept these risks and contract documents may permit its use for certain applications. For example, carbon steel media may be allowed when preparing less alloyed stainless steels (e.g., ferritic stainless steels).

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, less dense abrasives should be

considered for softer alloys. Sections A1 through A3 contain further guidance.

A15.1.1 Finer, softer, 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, but are not limited to, 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. If higher pressures (e.g., 0.62 MPa [90 psi]) are used for removal of intact coating, a greater stand-off distance may be required to reduce the risk of damaging some alloys and shapes as described in A9 and A10.

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, but not limited to, 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.

A16 SURFACE PROFILE: Surface profile is the roughness of the surface that results from abrasive blast cleaning. The profile height is dependent on the size, shape, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of abrasive recycling, and the proper maintenance of working mixtures of grit, shot, or both. Large particle-sized abrasives may produce a surface profile that may be too high to be adequately covered by a single thin-film coat. Accordingly, the use of larger abrasives should be avoided in these

⁽⁴⁾ The SSPC-NACE wet abrasive blast cleaning standards define surface preparation water as "water of sufficient purity and quality that it does not prevent the surface being cleaned from achieving the specified degree of surface cleanliness or nonvisible contaminant criteria contained in the procurement documents (project specification)"

cases. However, larger abrasives may be needed for thick-film coatings or to facilitate removal of thick coatings or heavy oxides.

A16.1 The surface profile should be measured in accordance with ASTM D4417, ASTM D7127, or as specified in the procurement documents. Compliance with specified profile requirements should be determined in accordance with SSPC-PA 17, or as specified in the procurement documents.

A16.2 A standard surface profile of 40 to 75 micrometers [~ 1.5 to 3.0 mils] is suitable for many applications. However, factors such as the substrate material, thickness of the coating to be applied, generic type of coating to be applied service environment, and geometry of the component may dictate a different profile. The profile requirements should be addressed in the procurement documents (project specification).

A16.3 Profile Texture (Roughness): A profile produced by a round abrasive (stainless-steel shot) will have a different texture than a profile produced by an angular abrasive (stainless-steel grit, cut wire, or mineral abrasives). The surface roughness can be measured quantitatively with a stylus instrument as described in ASTM D7127, however it is also common to specify an “angular” profile, but not measure it quantitatively. An “angular” profile is generally produced with angular abrasives and may be confirmed using surface

profile comparators. Properly blended angular and shot media can also produce an angular profile. The roughness requirements should be addressed in the procurement documents (project specification).

A17 FILM THICKNESS: It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry film thickness of the coating above the peaks of the surface profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature oxidation or coating failure may occur. To ensure that coating thicknesses are accurately measured, the procedures in SSPC-PA 2 for verification of accuracy of Type 2 gauges should be used.

Because this standard covers a wide variety of alloys, it is critical to ensure that the film thickness gage has been properly adjusted on a sample of the same alloy being coated.

A18 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. Therefore, the temperature of the metal surface should be at least 3°C (5°F) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations and to avoid the application of coating over a damp surface.

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