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Joint Surface Preparation Standard

NACE No. 4/SSPC-SP 7
Brush-Off Blast Cleaning

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Foreword

This joint standard covers the use of blast cleaning abrasives to achieve a defined degree of cleaning of steel surfaces prior to the application of a protective coating or lining system. This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others who may be responsible for defining a standard degree of surface cleanliness.

The focus of this standard is brush-off blast cleaning. White metal blast cleaning, near-white metal blast cleaning, commercial blast cleaning, and industrial blast cleaning are addressed in separate standards.

Brush-off blast cleaning provides a lesser degree of cleaning than industrial blast cleaning (NACE No. 8/SSPC-SP 14[(1)]).

The difference between an industrial blast and a brush-off blast is that the objective of a brush-off blast is to allow as much of an existing coating to remain as possible, and to roughen the surface prior to coating application while the purpose of the industrial blast is to remove most of the coating, mill scale, and rust, when the extra effort required to remove every trace of these is determined to be unwarranted.

This joint standard was originally prepared in 1994 and revised in 2000 by the SSPC/NACE Task Group A on Surface Preparation by Abrasive Blast Cleaning. This joint Task Group includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation.

[(1)] NACE No. 8/SSPC-SP 14 (latest revision), “Industrial Blast Cleaning” (Houston, TX: NACE, and Pittsburgh, PA: SSPC).

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Section 1: General

1.1 This joint standard covers the requirements for brush-off blast cleaning of unpainted or painted steel surfaces by the use of abrasives. These requirements include the end condition of the surface and materials and procedures necessary to achieve and verify the end condition.

1.2 This joint standard allows tightly adherent rust, mill scale, and/or old coating to remain on the surface.

1.3 The mandatory requirements are described in Sections 1 to 9. NOTE: Section 10, "Comments," and Appendix A, "Explanatory Notes," are not mandatory requirements of this standard.

Section 2: Definitions

2.1 A brush-off blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed.

2.2 The entire surface shall be subjected to the abrasive blast. The remaining mill scale, rust, or coating shall be tight. Flecks of the underlying steel need not be exposed whenever the original substrate consists of intact coating.

2.3 When a coating is specified, the surface shall be roughened to a degree suitable for the specified coating system.

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

2.5 Visual standards or comparators may be specified to supplement the written definition. In any dispute, the written standards shall take precedence over visual standards and comparators. Additional information on visual standards is available in Paragraph A4 of Appendix A.

Section 3: References

3.1 The documents referenced in this standard are listed in Paragraph 3.4.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this standard, the requirements of this standard shall prevail.

3.4 SSPC: The Society for Protective Coatings Standards:

AB 1	Mineral and Slag Abrasives
AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
PA 3	A Guide to Safety in Paint Applications
SP 1	Solvent Cleaning
VIS 1	Visual Standard for Abrasive Blast Cleaned Steel

Section 4: Procedures Before Blast Cleaning

4.1 Before blast cleaning, visible deposits of oil, grease, or other contaminants shall be removed in accordance with SSPC-SP 1[(2)] or other agreed-upon methods.

4.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification). Additional information on surface imperfections is available in Paragraph A5 of Appendix A.

[(2)] SSPC-SP 1 (latest revision), "Solvent Cleaning" (Pittsburgh, PA: SSPC).

4.3 If a visual standard or comparator is specified to supplement the written standard, the condition of the steel prior to blast cleaning should be determined before the blasting commences. Additional information on visual standards and comparators is available in Paragraph A4 of Appendix A.

Section 5: Blast Cleaning Methods and Operation

5.1 Clean, dry compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve this requirement.

5.2 Any of the following methods of surface preparation may be used to achieve a brush-off blast cleaned surface:

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

5.2.2 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.

5.2.3 Dry abrasive blasting using a closed-cycle, recirculating abrasive system with centrifugal wheels and abrasive.

5.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a brush-off blast cleaned surface by mutual agreement between those responsible for performing the work and those responsible for establishing the requirements. NOTE: Information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Paragraph A9 of Appendix A.

Section 6: Blast Cleaning Abrasives

6.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, the type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

6.2 The cleanliness and size of recycled abrasives shall be maintained to ensure compliance with this standard.

6.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other contaminants as determined by the test methods found in SSPC-AB 1,[3] AB 2,[4] and AB 3.[5]

6.4 Any limitations on the use of specific abrasives, the quantity of contaminants, or the degree of allowable embedment shall be included in the procurement documents (project specification) covering the work, because abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements. NOTE: Additional information on abrasive selection is given in Paragraph A2 of Appendix A.

Section 7: Procedures Following Blast Cleaning and Immediately Prior to Coating

7.1 Visible deposits of oil, grease, or other contaminants shall be removed according to SSPC-SP 1 or another method agreed upon by those parties responsible for establishing the requirements and those responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning, or other methods agreed upon by those responsible for establishing the requirements and those responsible for performing the work. NOTE: The presence of toxic metals in the abrasives or paint being removed may place restrictions on the methods of cleaning permitted. The method chosen shall comply with all applicable regulations. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

7.3 After blast cleaning, any remaining surface imperfections (e.g., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required by the procurement documents (project

[3] SSPC-AB 1 (latest revision), “Mineral and Slag Abrasives” (Pittsburgh, PA: SSPC).
[4] SSPC-AB 2 (latest revision), “Specification for Cleanliness of Recycled Ferrous Metallic Abrasives” (Pittsburgh, PA: SSPC).
[5] SSPC-AB 3 (latest revision), “Newly Manufactured or Re-Manufactured Steel Abrasives” (Pittsburgh, PA: SSPC).

specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Paragraph 2.3. NOTE: Additional information on surface imperfections is contained in Paragraph A5 of Appendix A.

Section 8: Inspection

8.1 Work and materials supplied under this standard are subject to inspection by a representative of those responsible for establishing the requirements. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by those responsible for establishing the requirements and those responsible for performing the work.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, a procedure mutually agreeable to purchaser and supplier shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

Section 9: Safety and Environmental Requirements

9.1 Because abrasive blast cleaning is a hazardous operation, all work shall be conducted in compliance with applicable occupational and environmental health and safety rules and regulations. NOTE: SSPC-PA 3[6] addresses safety concerns for coating work.

Section 10: Comments

10.1 Additional information and data relative to this standard are contained in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM,[7] "Surface Preparation Commentary." The recommendations contained in Appendix A and SSPC-SP COM are believed to represent good practice, but are not to be considered requirements of the standard. The sections of SSPC-SP COM that discuss subjects related to brush-off blast cleaning are as follows.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Wet Abrasive Blast Cleaning	8.2
Maintenance Repainting	4.2
Rust-back (Re-rusting)	8.3
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1

Appendix A: Explanatory Notes

A1 FUNCTION: Brush-off blast cleaning (NACE No. 4/SSPC-SP 7[8]), provides a lesser degree of cleaning than industrial blast cleaning (NACE No. 8/SSPC-SP 14). It should be used when the service environment is mild enough to permit tight mill scale, coating, rust, and other foreign matter to remain on the surface. The primary functions of blast cleaning 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 roughness and enhance the adhesion of the new coating system. The hierarchy of blasting standards is as follows: white metal blast cleaning, near-white metal blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning.

A2 ABRASIVE SELECTION: Types of metallic and nonmetallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important

[6] SSPC-PA 3 (latest revision), "Guide to Safety in Paint Application" (Pittsburgh, PA: SSPC).
[7] SSPC-SP COM (latest revision), "Surface Preparation Specifications Surface Preparation Commentary" (Pittsburgh, PA: SSPC).
[8] NACE No. 4/SSPC-SP 7 (latest revision), "Brush-Off Blast Cleaning" (Houston, TX: NACE, and Pittsburgh, PA: SSPC).

to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, 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 prepared steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are provided in SSPC-AB 1, SSPC-AB 2, and SSPC-AB 3.

A3 SURFACE PROFILE: Surface profile is the roughness of the surface that results from abrasive blast cleaning. The profile depth (or 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 recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent on the thickness of the coating to be applied. Large particle-sized abrasives (particularly metallic) can produce a profile that may be too deep to be adequately covered by a single thin-film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick-film coatings or to facilitate removal of thick coatings, heavy mill scale, or rust. If control of profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical maximum profile heights achieved with commercial abrasive media are shown in Table 8 of SSPC-SP COM. Surface profile should be measured in accordance with NACE Standard RP0287,[9] "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using Replica Tape," or ASTM[10] D 4417,[11] "Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel."

A4 VISUAL STANDARDS: SSPC-VIS 1[12] provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The series A-SP 7, B-SP 7, C-SP 7, and D-SP 7 depicts surfaces cleaned to brush-off blast grade. Other available visual standards are described in Section 7 of SSPC-SP COM.

A5 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features that are difficult to properly cover and protect include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., against the costs of a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Proper planning for such surface repair work is essential because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4 of SSPC-SP COM and NACE Standard RP0178,[13] "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to Be Lined for Immersion Service," contain additional information on surface imperfections.

A6 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (e.g., chlorides and sulfates) develops rust-back rapidly at intermediate and high levels of humidity. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during blast cleaning if the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, preferably before blast cleaning, and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in NACE No. 5/SSPC-SP 12,[14] "Surface Preparation of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating." Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-TU 4,[15] "Technology Update on Field Methods for Retrieval and Analysis of Soluble Salts on Substrates."

A7 RUST-BACK: Rust-back occurs when freshly cleaned steel is exposed to moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back varies greatly from one environment to another. Under mild ambient conditions, if chemical contamination is not present (see Paragraph A6), it is best to blast clean and coat a surface on the same day. Severe conditions may

[9] NACE Standard RP0287 (latest revision), "Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surface Using a Replica Tape" (Houston, TX: NACE).
[10] ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.
[11] ASTM D 4417 (latest revision), "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel" (West Conshohocken, PA: ASTM).
[12] SSPC-VIS 1 (latest revision), "Visual Standard for Abrasive Blast Cleaning Steel" (Pittsburgh, PA: SSPC).
[13] NACE Standard RP0178 (latest revision), "Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to Be Lined for Immersion Service" (Houston, TX: NACE).
[14] NACE No. 5/SSPC-SP 12 (latest revision), "Surface Preparation of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating" (Houston, TX: NACE, and Pittsburgh, PA: SSPC).
[15] SSPC-TU 4 (latest revision), "Field Methods for Retrieval and Analysis of Soluble Salts on Substrates" (Pittsburgh, PA: SSPC).

require more expedient coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating (see Section A6).

A8 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of the steel surface 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.

A9 WET ABRASIVE BLAST CLEANING: Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing. It may be necessary to add inhibitors to the water or apply them to the surface immediately after blast cleaning to temporarily prevent rust formation. The coating should then be applied before any rusting is visible. 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.

A10 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 profile should equal the thickness known to be needed for the desired protection. If the dry-film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured the procedures in SSPC-PA 2,[16] "Measurement of Dry Coating Thickness with Magnetic Gages," should be used.

A11 MAINTENANCE AND REPAIR COATING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, the cleaning shall be performed across the entire specified area. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning shall be applied 100% to all weld seams. If the entire structure is to be prepared, this degree of cleaning shall be applied to 100% of the entire structure. SSPC-PA 4,[17] "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

[16] SSPC-PA 2 (latest revision), "Measurement of Dry Coating Thickness with Magnetic Gages" (Pittsburgh, PA: SSPC).
[17] SSPC-PA 4 (latest revision), "Guide to Maintenance Painting with Oil Base or Alkyd Painting Systems" (Pittsburgh, PA: SSPC).