Item No. 21065

Joint Surface Preparation Standard

NACE No. 1/SSPC-SP 5
White Metal Blast Cleaning

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Reaffirmed 2006-09-13
Reaffirmed 1999-09-07
Approved October 1994

ISBN 1-57590-107-2
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Printed by NACE International

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 white metal blast cleaning. Near-white metal blast cleaning, commercial blast cleaning, industrial blast cleaning, and brush-off blast cleaning are addressed in separate standards.

White metal blast cleaning provides a greater degree of cleaning than near-white metal blast cleaning (NACE No. 2/SSPC-SP 10[1]).

The difference between a white metal blast and a near-white metal blast is that a white metal blast removes all of the coating, mill scale, rust, oxides, corrosion products, and other foreign matter from the surface. Near-white metal blasting allows light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating to remain on no more than 5 percent of each unit area of surface as defined in NACE No. 2/SSPC-SP 10.

This joint standard was originally prepared in 1994 and reaffirmed in 1999 by the SSPC/NACE Task Group (TG) A on Surface Preparation by Abrasive Blast Cleaning. This joint TG includes members of both the SSPC Surface Preparation Committee and the NACE Unit Committee T-6G on Surface Preparation. It was reaffirmed in 2006 by NACE Specific Technology Group (STG) 04, Protective Coatings and Linings: Surface Preparation, and the SSPC Surface Preparation Committee.

In NACE/SSPC standards, the terms *shall, must, should,* and *may* are used in accordance with Paragraph 2.2.1.8 of the Agreement Between NACE International and SSPC: The Society for Protective Coatings. The terms *shall* and *must* are used to state mandatory requirements. The term *should* is used to state something considered good and is recommended but is not mandatory. The term *may* is used to state something considered optional.

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Section 1: General

1.1 This joint standard covers the requirements for white metal blast cleaning of uncoated or coated 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 The mandatory requirements are described in Sections 1 to 9. Section 10, "Comments," and Appendix A, "Explanatory Notes," are not mandatory requirements of this standard.

1.3 Information about the function of white metal blast cleaning is in Paragraph A1 of Appendix A.

1.4 Information about use of this standard in maintenance coating work is in Paragraph A2 of Appendix A.

Section 2: Definitions

2.1 **White Metal Blast Cleaned Surface:** A white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter.

2.1.1 Acceptable variations in appearance that do not affect surface cleanliness as defined in Paragraph 2.1 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat-affected zones, blasting abrasives, and differences because of blasting technique.

2.1.2 SSPC-VIS 1[2] may be specified to supplement the written definition. In any dispute, the written definition set forth in this standard shall take precedence over reference photographs and comparators. Additional information on reference photographs and comparators is in Paragraph A3 of Appendix A.

Section 3: Associated Documents

3.1 The latest issue, revision, or amendment of the documents listed in Paragraph 3.3 in effect on the date of invitation to bid shall govern unless otherwise specified.

3.2 If there is a conflict between the requirements of any of the documents listed in Paragraph 3.3 and this standard, the requirements of this standard shall prevail.

3.3 Documents cited in the mandatory sections of this standard include:

Document	Title
SSPC-AB 1[3]	Mineral and Slag Abrasives
SSPC-AB 2[4]	Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-AB 3[5]	Ferrous Metallic Abrasives
SSPC-SP 1[6]	Solvent Cleaning
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

Section 4: Procedures Before Cleaning

4.1 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.

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 in Paragraph A4 of Appendix A.

4.3 If reference photographs or comparators are 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 reference photographs and comparators is in Paragraph A3 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 white metal 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 blast cleaning) may be used to achieve a white metal blast cleaned surface by mutual agreement between those responsible for establishing the requirements and those responsible for performing the work. Information on the use of inhibitors to prevent the formation of rust immediately after wet abrasive blast cleaning is in Paragraph A5 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 used, the finished surface to be produced (cleanliness and surface profile [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, SSPC-AB 2, and SSPC-AB 3.

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. Additional information on abrasive selection is in Paragraph A6 of Appendix A.

6.5 When a coating is specified, the cleaned surface shall be roughened to a degree suitable for the specified coating system. Additional information on surface profile and the film thickness of coating applied over the surface profile is in Paragraphs A7 and A8 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.

7.2.1 The presence of toxic metals in the abrasives or coating being removed may place restrictions on the methods of cleaning permitted. The chosen method shall comply with all applicable regulations.

7.2.2 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) shall be removed to the extent required by the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Paragraph 6.5. Additional information on surface imperfections is in Paragraph A4 of Appendix A.

7.4 Immediately prior to coating application, the entire surface shall comply with the degree of cleaning specified in this standard. Any visible rust that forms on the surface of

the steel after blast cleaning shall be removed by recleaning the rusted areas before coating. Information on chemical contamination, rust-back (rerusting), and the effect of dew point (surface condensation) is in Paragraphs A9, A10, and A11 of Appendix A.

Section 8: Inspection

8.1 Work performed 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.

Section 10: Comments (Nonmandatory)

10.1 Additional information and data relative to this standard are in Appendix A. Detailed information and data are presented in a separate document, SSPC-SP COM.[7] The recommendations 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 white metal blast cleaning are listed below.

Subject	Commentary Section
Abrasive Selection	6
Film Thickness	10
Maintenance Repainting	4.2
Reference Photographs	11
Rust-Back (Rerusting)	8.3
Surface Profile	6.2
Weld Spatter	4.4.1
Wet Abrasive Blast Cleaning	8.2

References

1. NACE No. 2/SSPC-SP 10 (latest revision), “Near-White Metal Blast Cleaning” (Houston, TX: NACE, and Pittsburgh, PA: SSPC).

2. SSPC-VIS 1 (latest revision), “Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning” (Pittsburgh, PA: SSPC).

3. SSPC-AB 1 (latest revision), “Mineral and Slag Abrasives” (Pittsburgh, PA: SSPC).

4. SSPC-AB 2 (latest revision), “Cleanliness of Recycled Ferrous Metallic Abrasives” (Pittsburgh, PA: SSPC).

5. SSPC-AB 3 (latest revision), “Ferrous Metallic Abrasives” (Pittsburgh, PA: SSPC).

6. SSPC-SP 1 (latest revision), “Solvent Cleaning” (Pittsburgh, PA: SSPC).

7. SSPC-SP COM (latest revision), “Surface Preparation Commentary for Steel and Concrete Substrates” (Pittsburgh, PA: SSPC).

8. SSPC-PA Guide 4 (latest revision), “Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems” (Pittsburgh, PA: SSPC).

9. "Visual Comparator for Surface Finishing of Welds Prior to Coating," Visual Aid for Use with NACE SP0178 (formerly RP0178)(latest revision) (Houston, TX: NACE).

10. NACE SP0178 (formerly RP0178) (latest revision), "Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service" (Houston, TX: NACE).

11. NACE Standard RP0287 (latest revision), "Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape" (Houston, TX: NACE).

12. ASTM(1) D 4417 (latest revision), "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel" (West Conshohocken, PA: ASTM).

13. SSPC-PA 2 (latest revision), "Measurement of Dry Coating Thickness with Magnetic Gages" (Pittsburgh, PA: SSPC).

14. NACE No. 5/SSPC-SP 12 (latest revision), "Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating" (Houston, TX: NACE, and Pittsburgh, PA: SSPC).

15. SSPC-Guide 15 (latest revision), "Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates" (Pittsburgh, PA: SSPC).

Appendix A: Explanatory Notes (Nonmandatory)

A1 FUNCTION: White metal blast cleaning (NACE No. 1/SSPC-SP 5) provides the greatest degree of cleaning. It should be used when the highest degree of blast cleaning is required. 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 profile (roughness) to 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 MAINTENANCE COATING WORK: When this standard is used in maintenance coating work, specific instructions should be provided on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. In these cases, this degree of cleaning applies to the entire specified area. For example, if all weld seams are to be cleaned in a maintenance operation, this degree of cleaning applies to 100 percent of all weld seams. If the entire structure is to be prepared, this degree of cleaning applies to 100 percent of the entire structure. SSPC-PA Guide 4[8] provides a description of accepted practices for retaining old sound coating, removing unsound coating, feathering, and spot cleaning.

A3 REFERENCE PHOTOGRAPHS AND COMPARATORS: SSPC-VIS 1 provides color photographs for the various grades of surface cleaning as a function of the initial condition of the steel. The photographs A SP 5, B SP 5, C SP 5, D SP 5, G_1 SP 5, G_2 SP 5, and G_3 SP 5 depict surfaces cleaned to white metal. In addition, the photographs A SP 5 M and A SP 5 N depict surfaces cleaned by various metallic and nonmetallic abrasives to SP 5 condition. The NACE "Visual Comparator for Surface Finishing of Welds Prior to Coating"[9] is a plastic weld replica that complements NACE SP0178.[10] Other available reference photographs and comparators are described in Section 11 of SSPC-SP COM.

A4 SURFACE IMPERFECTIONS: Surface imperfections can cause premature coating 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 cover and protect properly include crevices, weld porosities, laminations, etc. The high cost of the methods to remedy surface imperfections (such as edge rounding and weld spatter removal) should be weighed 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 cleaning has been completed. Repair of such surface defects should be planned properly because the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4.4 of SSPC-SP COM and NACE SP0178 contain additional information on surface imperfections.

A5 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 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.

(1) ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

A6 ABRASIVE SELECTION: Types of metallic and nonmetallic abrasives are discussed in SSPC-SP COM. Blasting abrasives may become embedded in, or leave residues on, the surface of the steel during cleaning. While such embedment or residues are normally 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 cleaned steel is to be used in an immersion environment). Criteria for selecting and evaluating abrasives are in SSPC-AB 1, SSPC-AB 2, and SSPC-AB 3.

A7 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 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 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 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 surface profile (minimum/maximum) is deemed to be significant to coating performance, it should be addressed in the procurement documents (project specification). Typical surface profile heights achieved with commercial abrasive media are shown in Table 6 of SSPC-SP COM. Surface profile should be measured in accordance with NACE Standard RP0287[11] or ASTM D 4417.[12]

A8 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 coating failure will occur. To ensure that coating thicknesses are properly measured, the procedures in SSPC-PA 2[13] should be used.

A9 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 and eliminating sources of recontamination during and after blast cleaning. Wet methods of removal are described in NACE No. 5/SSPC-SP 12.[14] Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests as described in SSPC-Guide 15.[15]

A10 RUST-BACK: Rust-back (rerusting) 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 (see Paragraph A9) is not present, it is best to blast clean and coat a surface on the same day. Severe conditions may require a more expeditious coating application to avoid contamination from fallout. Chemical contamination should be removed prior to coating.

A11 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.