SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 11

Power Tool Cleaning to Bare Metal

1. Scope

1.1 This specification covers the requirements for power tool cleaning to produce a bare metal surface and to retain or produce a surface profile.

1.2 This specification is suitable where a roughened, clean, bare metal surface is required, but where abrasive blasting is not feasible or permissible.

1.3 This specification differs from SSPC-SP 3, Power Tool Cleaning, in that SSPC-SP 3 requires only the removal of loosely adherent materials and does not require producing or retaining a surface profile.

2. Definition

2.1 Metallic surfaces which are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.

2.2 When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system. The surface profile shall not be less than 1 mil (25 micrometers). NOTE: Additional information on profile is contained in Sections A.5 and A.6 of the Appendix.

2.3 Photographs or other visual standards may be used to supplement the written definition. NOTE: Additional information on visual standards is available in Section A.7 of the Appendix.

3. Power Surface Preparation Tools and Media

3.1 SURFACE CLEANING POWER TOOLS: Any tool capable of appropriately driving the media of Section 3.3 is acceptable; the surface profile may or may not be destroyed.

3.2 IMPACT AND OTHER PROFILE PRODUCING POWER TOOLS: Any tool on which the media of Section 3.4 can be properly mounted and used to produce the required uniform profile is acceptable. NOTE: Information on suitable tools is found in Sections A.3.a and A.3.b of the Appendix.

3.3 SURFACE CLEANING MEDIA:

3.3.1 Non-woven abrasive wheels and discs constructed of a non-woven synthetic fiber web material of continuous undulated filaments impregnated with an abrasive grit. NOTE: Information on suitable discs and wheels is found in Section A.3.c of the Appendix.

3.3.2 Coated abrasive discs (sanding pads), coated abrasive flap wheels, coated abrasive bands or other coated abrasive devices capable of running on power tools. NOTE: Information on suitable wheels is found in Section A.3.d of the Appendix.

3.3.3 Other materials that produce the requirements of Section 2.1.

3.4 SURFACE PROFILE PRODUCING MEDIA:

3.4.1 Rotary impact flap assembly consisting of a flexible loop construction with carbide spheres bonded to the peening surfaces of each of the metal supports fastened to the loop. NOTE: Information on suitable flap assemblies is found in Section A.3.e of the Appendix.

3.4.2 Needle guns consisting of a bundle of wire “needles” which can impact a surface, producing a peened effect. NOTE: Information on suitable needles is found in Section A.3.f of the Appendix.

3.4.3 Other materials which, when mounted on power hand tools, can produce the profile required in Section 2.2.

4. Reference Standards

4.1 The standards referenced in this specification are listed in Section 4.4 and form a part of this specification.

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

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

4.4 SSPC SPECIFICATIONS:

SP 1	Solvent Cleaning
SP 3	Power Tool Cleaning
VIS 3	Visual Standard for Power- and Hand-Tool Cleaned Steel

5. Procedures Prior to Power Tool Surface Preparation

5.1 Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP 1, "Solvent Cleaning," or other agreed-upon methods.

5.2 Prior to power tool surface preparation, remove surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag to the extent required by the procurement documents (project specification). NOTE: Additional information on surface imperfections is available in Appendix A.9.

6. Power Tool Surface Preparation Methods and Operations

6.1 Depending on profile conditions, use either or both of the following methods to remove tightly adhering materials and to retain or produce the required surface profile with power tools:

6.1.1 Profile Condition A, Acceptable Profile Exists: Achieve the cleanliness required in Section 2.1 by using power tools described in Section 3.1.

6.1.2 Profile Condition B. Unacceptable Profile Exists: Achieve the cleanliness required in Section 2.1 and the profile required in Section 2.2 by using power tools described in Section 3. NOTE: Information on the selection of tools and cleaning media is found in Section A.2 of the Appendix.

7. Procedures Following Power Tool Surface Preparation

7.1 After power tool surface preparation and prior to the application of coatings, reclean the surface if it does not conform to this specification.

7.2 Remove visible deposits of oil, grease, or other contaminants by any of the methods specified in SSPC-SP 1 or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work. NOTE: Information on oil contamination is found in Section A.4.d of the Appendix.

7.3 Remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with oil-free, clean, dry air; vacuum cleaning; or wiping with a clean, dry cloth.

7.4 Power tool prepared surfaces must be coated prior to the reformation of rust or visible contamination.

8. Inspection

8.1 Surfaces prepared under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work as is found defective under this specification. In case of dispute, the arbitration or settlement procedure as established in the procurement documents (project specification), shall be followed. If no arbitration procedure is established, the procedure specified by the American Arbitration Association shall be used.

8.2 The procurement documents (project specification) covering work or purchase shall establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

9. Safety

9.1 All safety requirements stated in the procurement document as well as this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

10. Comments

10.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

10.2 Additional information and data relative to this specification are contained in the following Appendix. Additional detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in the Notes, Appendix, and SSPC-SP COM are believed to represent good practice, but are not to be considered as requirements of the specification. The table below lists the appropriate section of SSPC-SP COM.

Subject	Commentary Section
Film Thickness	10
Maintenance Painting	4.2
Rust-Back (Rerusting)	4.5
Visual Standards	11

A. Appendix

A.1 FUNCTION: Power tool surface preparation to remove tightly adherent material produces a surface which is visibly free from all rust, mill scale, and old coatings and which has a surface profile. It produces a greater degree of cleaning than SSPC-SP 3, "Power Tool Cleaning," (which does not remove tightly adherent material) and may be considered for coatings requiring a bare metal substrate.

The surfaces prepared according to this specification are not to be compared to surfaces cleaned by abrasive blasting. Although this method produces surfaces that "look" like "near-white" or "commercial blast," they are not necessarily equivalent to those surfaces produced by abrasive blast cleaning as called for in SSPC-SP 10 or SP 6.

A.2 SELECTION OF TOOLS AND CLEANING MEDIA: Selection of power tools and cleaning media shall be based on (1) the condition of the surface prior to surface preparation, (2) the extent of cleaning that is required to remove rust, scale and other matter from the surface and (3) the type of surface profile required.

A.2.1 Selection of Media: If an acceptable surface profile existed prior to preparing the surface, cleaning media, such as found in Section 3.3, shall be selected that will remove surface contaminants without severely reducing or removing the profile, if possible. If the surface profile is removed or severely reduced when preparing the surface, or if there was no profile prior to surface preparation, surface profiling media, such as found in Section 3.4, shall be selected that will produce an acceptable surface profile as required by this specification. When power tool cleaning rusted surfaces it is important to avoid embedding or peening rust into the substrate. This may require removal of rust prior to use of surface profiling media. These factors may require employing more than one type of medium in order to obtain the desired end result. NOTE: Power wire brushes when used alone will not produce the required surface profile and may remove or degrade an existing profile to an unacceptable level.

A.2.2 Selection of Tools: Power tools shall be selected on the basis of the size and speed rating of the media. These requirements may differ from one type of media to another and shall be taken into consideration when more than one type of medium will be used in the surface preparation process. Power tools shall be selected that will produce enough power to perform the cleaning operation efficiently. Operator fatigue shall be considered in the selection of power tools.

Further information on the selection of power tools and media is contained in Chapter 2.6, "Hand and Power Tool Cleaning," of SSPC Painting Manual, Volume 1, "Good Painting Practice."

A.3 SUITABLE TOOLS AND MEDIA: The text of this specification makes reference to the following footnotes. Inclusion of these items in this appendix is intended solely to guide the user to typical types of equipment and media which are available to meet the specification. The items mentioned are not all of the tools or products available, nor does their mention constitute an endorsement by SSPC.

a. The "Mini-Flushplate" from Desco Manufacturing Company, Inc., Long Beach, California, has been found suitable as a tool system which meets the requirements of this section.

b. The Aro Corporation, Bryan, Ohio, and VON ARX Air Tools Company, Englewood, New Jersey, are suppliers of needle gun equipment.

c. 3M Scotch-Brite Clean 'n Strip discs and wheels are able to satisfy the requirements.

d. Grind-O-Flex wheels from Merit Corporation, Compton, California and Nu-Matic air inflated wheels from NuMatic, Euclid, Ohio, have been found suitable.

e. 3M Heavy-Duty Roto-Peen flap assembly has been found suitable.

f. Needles having a diameter of 2 mm have been found to produce a surface profile suitable for many painting systems.

A.4 OPERATION OF TOOLS: The tools shall be operated in accordance with the manufacturers' instructions. In particular, note the following:

a. Observe the recommended operating speed (ROS). The maximum operating speed (MOS) does not necessarily give the most efficient cleaning.

b. The "rpm" (rotational speed) rating of some power tools and the cleaning media may not be compatible and could result in physical injury to the operator.

c. Exercise caution when power tools are used at critical structures (e.g., pressure vessel boundaries) so that excessive base metal is not removed.

d. When air driven tools are used, the exhaust could contain oil or moisture that could easily contaminate the recently prepared surface.

e. The media used on power tools have a finite life. When they do not produce the specified profile they shall be replaced.

Additional information on the operation of tools can be found in Chapter 2.6 of Volume 1, "Good Painting Practice" of SSPC Painting Manual.

A.5 PROFILE: The type of power tools to be used depends upon whether or not an acceptable profile exists on the surface to be cleaned.

Some limitations of the various types of media to produce a specific profile or to preserve an existing profile are as follows:

- Media of Section 3.3 produce a profile of approximately one-half mil (10-15 micrometers), whereas the media of Section 3.4 may produce a profile of 1 mil (25 micrometers) or more. The profile depends on the abrasive embedded in the rotary flaps or the diameter of the needles.
- Impact tools may produce sharp edges or cut into the base metal if not used properly.
- It is important to determine whether the profile requirements for the specified coating system can be met by this power tool cleaning method of surface preparation.

A.6 MEASUREMENT OF SURFACE PROFILE: Surface profile comparators and other visual or tactile gages used for abrasive blast cleaning are not suitable for measuring profile produced by power tools because of the differences in appearance. One acceptable procedure is use of coarse or extra coarse replica tape, as described in Method C of ASTM D 4417, "Field Measurement of Surface Profile of Blast Cleaned Steel." Replica tapes are valid for profiles in the ranges of 0.8 to 1.5 mils (20 to 38 micrometers) (coarse) to 1.5-4.5 mils (38-114 micrometers) (extra-coarse). (Note: Because of the limitations in compressibility of the mylar film, however, even very smooth surfaces will give readings of 0.5 mils [13 micrometers] or greater using the replica tape.)

A.7 VISUAL STANDARDS: Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents.

SSPC-VIS 3, "Visual Standard for Power- and Hand-Tool Cleaned Steel," provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. For more information about visual standards, see SSPC-SP COM, Section 11.

A.8 INACCESSIBLE AREAS: Because of the shape and configuration of the power tools themselves, some areas of a structure may be inaccessible for cleaning. These areas include surfaces close to bolt heads, inside corners, and areas with limited clearance. Areas which are inaccessible by this method of surface preparation shall be cleaned using an alternate method of surface preparation which may result in a different degree of surface cleanliness and surface profile. The alternate method shall be mutually agreed upon before commencing work.

A.9 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the environment is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features which are difficult to properly cover and protect include crevices, weld porosity, laminations, etc. The high cost of methods to remedy the surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adherent contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, must be removed during the power tool cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such repair work is essential, since the timing of the repairs may occur before, during, or after the cleaning operation. Section 4.4 of the "Surface Preparation Commentary" (SSPC-SP COM) contains additional information on surface imperfections.

A.10 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (i.e., chlorides and sulfates) develops rustback rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to cleaning as a result of atmospheric contamination. In addition, contaminants can be deposited on the steel surface during cleaning whenever the media is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, preferably before power tool cleaning, and eliminating sources of recontamination during and after power tool cleaning. Identification of the contaminants along with their concentrations may be obtained from laboratory or field tests.

A.11 RUST-BACK: Rust-back (rerusting) occurs when freshly cleaned steel is exposed to conditions of high humidity, moisture, contamination, or a corrosive atmosphere. The time interval between power tool cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions, it is best to clean and coat a surface the same day. Severe conditions may require coating more quickly, while for exposure under controlled conditions the coating time may be extended. Under no circumstances shall the steel be permitted to rust-back before painting regardless of time elapsed (see Section A. 10).

A.12 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 5 ˚F (3 ˚C) above the dew point during power tool cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during cleaning operations. It is important that the application of a coating over a damp surface be avoided.

A.13 FILM THICKNESS: It is essential that ample coating be applied after power tool cleaning to adequately cover the peaks of the surface profile. The dry film thickness above the peaks of the profile shall 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, refer to SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages."

A.14 MAINTENANCE AND REPAIR PAINTING: When this specification is used in maintenance painting, specific instructions shall be given on the extent of surface to be power tool cleaned or spot cleaned. SSPC-PA Guide 4, "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound paint, removing unsound paint, feathering, and spot cleaning.