SSPC: The Society for Protective Coatings

SURFACE PREPARATION SPECIFICATION NO. 15

Commercial Grade Power Tool Cleaning

1. Scope

1.1 This standard covers the requirements for power tool cleaning to provide a commercial grade power tool cleaned steel surface and to retain or produce a minimum 25 micrometer (1.0 mil) surface profile (see Notes 10.1 and 10.2).

1.2 This standard differs from SSPC-SP 3, Power Tool Cleaning, in that a higher degree of surface cleanliness is required and a minimum surface profile of 25 micrometers (1.0 mil) will be retained or produced. See definition in Section 2.4 below.

1.3 This standard differs from SSPC-SP 11, Power Tool Cleaning to Bare Metal, in that stains of rust, paint, or mill scale may remain on the surface.

2. Definition

2.1 A commercial grade power tool cleaned steel surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, rust, -coating, oxides, mill scale, corrosion products, and other foreign matter, except as noted in Section 2.2 (see Notes 10.3 and 10.4).

2.2 Random staining shall be limited to no more than 33 percent of each unit area of surface as defined in Section 2.6. Staining may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.

2.3 Acceptable variations in appearance that do not affect surface cleanliness as defined in Sections 2.1 and 2.2 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, or the type of power tool used.

2.4 The surface profile roughness shall be a minimum of 25 micrometers (1.0 mil), as measured in accordance with Method C of ASTM D 4417 or other mutually agreed-upon method (see Notes 10.5, 10.6, and 10.7). The peaks and valleys on the surface shall form a continuous pattern with no smooth, unprofiled spots in between. NOTE: The appearance of a profile resulting from power tool cleaning is different from the appearance of a profile created by abrasive blast cleaning.

2.5 Immediately prior to paint application, the surface shall comply with the degree of cleaning specified herein.

2.6 Unit area for determining staining shall be approximately 6400 mm^2 (9 in^2) (i.e., a square 80 x 80 mm [3 x 3 inches]).

3. Surface Preparation Power Tools and Media

3.1 SURFACE CLEANING POWER TOOLS: Any tool on which the media described in Section 3.3 can be properly mounted and used to produce the required surface profile is acceptable. These tools may or may not alter or destroy the existing surface profile.

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 surface profile is acceptable.

3.3 SURFACE CLEANING MEDIA: The media used to clean the surface shall consist of the following:

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.

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.

3.3.3 Other materials that produce the requirements of Sections 2.1 through 2.6.

3.3.4 A list of suitable types of media is found in Note 10.8.

3.4 IMPACT AND PROFILE PRODUCING MEDIA: The media used to clean the surface and produce a surface profile shall consist of the following:

3.4.1 Rotary impact flap assembly: Flaps of a flexible loop construction with abrasive media bonded to the peening surfaces of each of the studs fastened to the loop.

3.4.2 Needle gun: A bundle of steel needles (or chisels) is mounted in front of a piston that strikes them several times per second, impacting them against the surface being cleaned.

3.4.3 Cutter bundles consist of a number of carbon steel or tungsten carbide cutter assemblies that abrade a coating when rotated against a surface.

3.4.4 Hammer (flailer) assemblies consist of a number of carbon steel fingers that abrade a coating when rotated against a surface.

3.4.5 Suitable tools and media that produce the profile requirements of Section 2.4 are listed in Note 10.8. Guidance in the operation of power tools is given in Note 10.9

4. Referenced Standards

4.1 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern, unless otherwise specified. Standards marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this standard.

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

4.4 SSPC STANDARDS:

***PA 2**	Measurement of Dry Coating Thickness With Magnetic Gages
***PA Guide 4**	Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems
SP 1	Solvent Cleaning
***SP 3**	Power Tool Cleaning
***SP 6**	Commercial Blast Cleaning
***SP 11**	Power Tool Cleaning to Bare Metal
***VIS 3**	Visual Standard for Power and Hand Tool Cleaned Steel

4.5 ASTM INTERNATIONAL STANDARD:

D 4417	Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

5. Procedure for Power Tool Cleaning

5.1 Before power tool cleaning, visible deposits of oil, grease, or other materials that may interfere with coating adhesion shall be removed in accordance with SSPC-SP 1 or other agreed-upon methods. Nonvisible surface contaminants such as soluble salts shall be treated to the extent specified by the procurement documents [project specifications] (see Notes 10.10, 10.11, and 10.15).

5.2 Surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag shall be removed from the surface to the extent required by the procurement documents [project specifications] (see Note 10.12).

6. Power Tool Cleaning Methods

6.1 Any method or combination of methods of surface preparation may be used to achieve a commercial grade power tool cleaned surface. The surface produced shall meet the requirements of Sections 2.1, 2.2. and 2.4 (see Notes 10.8, 10.13 and 10.14).

6.2 Other methods of surface preparation may be used to achieve a commercial grade power tool cleaned surface by mutual agreement between the contracting parties.

6.3 Regardless of the method used for cleaning, if specified in the procurement documents for touch up work, feather the edges of paint surrounding the cleaned area so that the repainted surface can have a reasonably smooth appearance.

7. Procedures Following Power Tool Surface Preparation

7.1 Power tool prepared surfaces shall meet the requirements of this standard at the time of painting. Prior to painting, remove all visible deposits of oil and grease by any of the methods specified in SSPC-SP 1. (See Note 10.9.3 for information on oil contamination.) Remove dirt, dust, and similar contaminants from the surface. Acceptable methods include brushing, blowing-off with oil-free, clean, dry compressed air; vacuum cleaning; wiping with a clean dry cloth; or other methods agreed upon by the contracting parties.

8. Inspection

8.1 Surfaces prepared under this standard are subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work as is found defective under this standard. In case of dispute, the arbitration or settlement procedure established in the procurement documents shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and contractor shall be used.

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

9. Disclaimer

9.1 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 problems concerning safety associated with its use. The user of this standard, as well as the user of all products or practices described herein, is responsible for instituting appropriate health and safety practices and for ensuring compliance with all governmental regulations.

10. Notes

Notes are not requirements of this standard.

10.1 FUNCTION: The type of power tool surface preparation described in this standard removes adherent material, producing a surface, which except for staining, is free from rust, mill scale, and old coatings. The surface must also have a minimum 25 micrometer (1 mil) surface profile. Commercial grade power tool cleaning produces a greater degree of cleaning than SSPC-SP 3 (which does not remove adherent material) and a lesser degree of cleaning than SSPC-SP 11, which requires the removal of all visible materials and stains. Commercial grade power tool cleaning may be considered for coatings that can tolerate a small degree of staining or residual contaminants. The added surface preparation costs, compared to SSPC-SP 3, should be justified by the expected increase in coating performance.

This standard is suitable where a roughened, cleaned surface is required, but where abrasive blasting is not feasible or permissible. The surfaces prepared according to this standard should not be compared to surfaces cleaned by abrasive blast cleaning. Although this method produces surfaces that resemble a commercial blast (SSPC-SP 6), they are not necessarily equivalent to those surfaces produced by abrasive blast cleaning. The contracting parties should agree on the appropriateness of the finished surface to accept the specified coating system. Selection of power tools and cleaning media should be based on (1) the condition of the surface prior to surface preparation; (2) the extent of cleaning that is required; and (3) the surface profile required.

10.2 MAINTENANCE AND REPAIR PAINTING: When this standard is used in maintenance painting, specific instructions should be given on the extent of surface to be power tool cleaned or spot cleaned. SSPC-PA Guide 4 provides a description for retaining old sound paint, removing unsound paint, feathering, and spot cleaning.

10.3 VISUAL STANDARDS: Note that the use of visual standards in conjunction with this standard 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 provides a suitable comparative visual standard for SSPC-SP 3, SSPC-SP 11, and SSPC-SP 15. Visual standards for blast-cleaned steel are not suitable for assessing surfaces power tool cleaned to a commercial grade. Because power tool cleaning is a time and effort-sensitive method of cleaning, it is advisable to prepare a 5 to 9 m^2 (50 to 100 ft^2) test area to an acceptable level agreed upon by the contracting parties, and cover it with a clear lacquer to save it as a standard during the power tool cleaning operation. A 30 x 30 cm (12 x 12 inch) steel test plate can also be power tool cleaned to an acceptable level and sealed to serve as a project standard. Alternatively, such a field standard could be protected with a volatile corrosion inhibitor, tablet or impregnated paper, with or without a desiccant, and kept in a sealed plastic bag. This would permit examination of the surface profile.

10.4 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 that are inaccessible by this method of surface preparation should be cleaned using an alternative method. Because the alternative method may result in a different degree of surface cleanliness and surface profile, the contracting parties should agree upon the alternative method before starting the project.

10.5 MEASUREMENT OF SURFACE PROFILE: Surface profile comparators and other visual or tactile gages used for abrasive blast cleaning are not suitable for measuring the profile produced by power tools because of the differences in appearance. The appearance of a profile resulting from power tool cleaning is different from the appearance of a profile created by abrasive blast cleaning. Method C of ASTM D 4417 is the preferred method of measuring profile of power tool cleaned metal.

Because of the limitations in compressibility of the emulsion film, users of replica tape are cautioned to select the tape appropriate for the profile being measured. Measurements outside the range specified for the tape should not be accepted.

The contracting parties may agree to measure profile with a mechanical or a digital profile gage.

10.6 PROFILE: The type of power tools to be used depends upon whether an acceptable profile exists on the surface to be cleaned. The ability of the various types of media to produce a profile or to preserve an existing profile is limited. The media of Section 3.3 produce a profile of approximately 13 micrometers (0.5 mils), whereas the media of Section 3.4 may produce a profile of 25 micrometers (1 mil) or more. The profile depends on the abrasive embedded in the rotary flaps or the diameter and sharpness 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.

10.7 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 should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate according to contract documents or manufacturer's specifications, premature rust through or failure will occur. To assure that coating thickness is properly measured, the procedures in SSPC-PA 2 should be used.

10.8 SUITABLE TOOLS AND MEDIA: Items identified in the text of this standard are only intended to guide the user to typical types of equipment and media that are available to meet the specification. The items identified do not include all of the tools or products available, nor does their mention constitute an endorsement by SSPC.

- Rotary impact cleaning using a rotary tool and rotary peening flaps
- Rotary impact cleaning using a rotary tool and cutter bundle
- Needle guns
- Right angle sanders with abrasive discs or wheels
- Right angle sanders with non-woven abrasive discs or wheels
- Straight shaft grinders with non-woven abrasive discs or wheels
- Hammer assemblies

10.9 OPERATION OF TOOLS: Prior to operation of tools, read the manufacturer's instructions. Additional information on the operation of power tools can be found in the SSPC Painting Manual, Volume 1 - Good Painting Practice.

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

10.9.2 The rotational speed (RPM) rating of some power tools and the cleaning media may not be compatible and could result in physical injury to the operator or persons in the immediate area.

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

10.9.4 The media used with power tools have a finite life. They should be replaced when they do not produce the specified profile.

10.10 CHEMICAL CONTAMINATION: Steel contaminated with soluble salts (i.e., chlorides and sulfates) develops rust-back 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 are 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.

10.11 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 on 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 should the steel be permitted to rust-back before painting, regardless of time elapsed.

10.12 SURFACE IMPERFECTIONS: Surface imperfections can cause premature failure when the environment is severe. Generally, 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 for a coating 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, should be removed during the power tool cleaning procedure. 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 power tool cleaning operations. Section 4.4 of the "Surface Preparation Commentary" (SSPC-SP COM) contains additional information on surface imperfections.

10.13 SELECTION OF TOOLS AND MEDIA

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

10.13.2 Selection of Media: If an acceptable surface profile existed prior to preparing the surface, cleaning media, such as found in Section 3.3, should be selected that will remove surface contaminants without reducing the existing profile, if possible. If the surface profile is reduced below the required minimum when preparing the surface, or if there is no profile prior to surface preparation, surface profiling media, such as found in Section 3.4, should be selected that will produce an

acceptable surface profile as required by this standard. When power tool cleaning rusted surfaces, it is important to avoid embedding or peening rust into the substrate. These factors may require employing more than one type of medium in order to obtain the desired end result.

Power wire brushes or sanding discs when used alone will not produce the required surface profile and may remove or degrade an existing profile to an unacceptable level. Exceedingly heavy deposits of corrosion products should be removed using hand or power tools prior to using surface profiling media. After removal of excessive corrosion, a structural inspection may be warranted.

Further information on the selection of power tools and media is contained in the SSPC Painting Manual, Volume 1 - Good Painting Practice.

10.14 DEW POINT: Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is recommended that the temperature of the steel surface be at least 3°C (5°F) 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 power tool cleaning operations. It is equally important to continue to monitor the surface temperature/dew point relationship until the coating is applied in order to avoid painting over a damp surface, unless the selected coating is specifically intended for application on damp substrates.

10.15 The Surface Preparation Commentary, SSPC-SP COM, contains additional information and data relevant to this specification. The Commentary is non-mandatory and is not a part of this specification. The table below lists the subjects discussed relevant to power tool cleaning and the appropriate Commentary Section.

Subject	**Commentary Section**
Film Thickness	10
Maintenance Painting	4.2
Rust Back	4.5
Rust, Stratified Rust, Pack Rust, and Rust Scale	4.3.1
Surface Profile	6.2
Visual Standards	11
Weld Spatter	4.4.1