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Surface Preparation Guide

Surface Preparation is key to the success of coating application. The integrity and performance of the coating will be reduced because of improperly prepared surfaces.

Resources to help prepare your surfaces:

- Guidelines for previously prepared surfaces
- Recommendations for touch-up, maintenance and repair
- Standards for non-ferrous metal surfaces and concrete
- SSPC/NACE standards

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SURFACE PREPARATION

Coating performance is directly affected by surface preparation. Coating integrity and service life will be reduced because of improperly prepared surfaces. As high as 80% of all coating failures can be directly attributed to inadequate surface preparation that affects coating adhesion. Selection and implementation of the proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system. The majority of paintable surfaces are either concrete or ferrous metal, including galvanized metal and aluminum. They all require protection to keep them from corroding in aggressive environments. Selection of the proper method for surface preparation depends on the substrate, the environment, the coating selected, and the expected service life of the coating system. Economics, surface contamination, and the environment will also influence the selection of surface preparation methods.

PREVIOUSLY COATED SURFACES

Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers must be removed to ensure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Washing with an abrasive cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Recognize that any surface preparation short of total removal of the old coating may compromise the service life of the system. Check for compatibility by applying a test patch of the recommended coating system, covering at least two to three square feet. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required.

TOUCH-UP, MAINTENANCE, AND REPAIR

For a protective coating system to provide maximum long-term protection, regularly scheduled maintenance is required. Maintenance includes inspection of painted areas, cleaning of surfaces to remove oils, chemicals, and other contaminants, and touch-up of areas where the coatings have been damaged. Highly corrosive areas, such as those subjected to frequent chemical spillage, corrosive fumes, and/or high abrasion or temperature, should be inspected frequently—every six months, for example. Areas exposed to less severe conditions, such as interiors and exteriors of potable water tanks, may be inspected annually to assess the condition of the coating system. The SSPC-VIS 2, Standard Method for Evaluating Degree of Rusting on Painted Steel Surfaces, can be used as a guide to determine appropriate touch-up and repair maintenance schedules.

NON-FERROUS METAL SURFACES AND CONCRETE

ALUMINUM

Remove all oil, grease, dirt, oxide, and other foreign materials by cleaning as per SSPC-SP1 Solvent Cleaning. Any Aluminum Oxide must be removed by acid etching after SSPC-SP1 Solvent Cleaning.

GALVANIZED METAL

Allow to weather a minimum of six months prior to coating. Clean per SSPC-SP1 using an alkaline detergent, such as trisodium phosphate and water, or a degreasing cleaner. Then, prime as required. Surfaces cleaned with detergents must be thoroughly rinsed with water to remove alkaline residue. The water should be hot or under pressure, preferably both. When weathering is not possible, first solvent clean with Mineral Spirits per SSPC-SP1 and apply a test area, priming as required. Allow the coating to cure at least one week before crosshatch adhesion testing ASTM D3359. If adhesion is poor, Brush Blast per SSPC-SP7/NACE 4 is necessary to remove these treatments.

DUCTILE IRON

National Association of Pipe Fabricators, Inc. www.napf.com

NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

This standard summarizes the surface preparation requirements for ductile iron. Included within this standard are the following:

NAPF 500-03-01	Solvent Cleaning
NAPF 500-03-02	Hand Tool Cleaning
NAPF 500-03-03	Power Tool Cleaning
NAPF 500-03-04	Abrasive Blast Cleaning for Ductile Iron Pipe
NAPF 500-03-05	Abrasive Blast Cleaning for Cast Ductile Iron Fittings

Attempting to apply steel surface preparation specifications to ductile iron is inappropriate and may actually result in damage to the pipe surface with subsequent reduced coating effectiveness and life expectancy.

CONCRETE

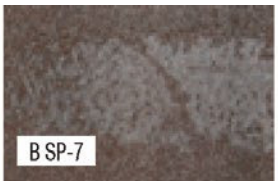
International Concrete Repair Institute www.icri.org

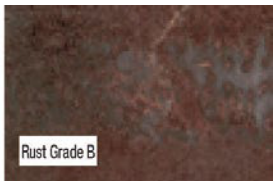
No. 03732 Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

This standard summarizes the capabilities, operating requirements, and limitations of the various methods used to prepare concrete surfaces for the application of protective sealers, coatings, and polymer overlays. Benchmark profiles are included that provide visual standards for purposes of specification, application, and verification.

ICRI 03732 identifies 12 different concrete surface preparation methods and uses nine profile replicates to use as a visual standard to ensure the specified Concrete Surface Profile (CSP 1-9) is achieved.

SSPC/NACE Standards





SSPC-SP-1 – SOLVENT CLEANING

Solvent Cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation. For complete instructions, refer to Society of Protective Coatings Surface Preparation Specification No.1.

SSPC-SP-2 – HAND TOOL CLEANING

Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1. For complete instructions, refer to Society of Protective Coatings Surface Preparation Specification No.2.

SSPC-SP-3 – POWER TOOL CLEANING

Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1. For complete instructions, refer to Society of Protective Coatings Surface Preparation Specification No.3.

SSPC-SP5/NACE 1 – WHITE METAL BLAST CLEANING

A White Metal Blast Cleaned surface, when viewed without magnification, should be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease should be removed by any of the methods specified in SSPC-SP1 or other agreed-upon methods. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP5/NACE 1.

SSPC-SP6/NACE 3 – COMMERCIAL BLAST CLEANING

A Commercial Blast Cleaned surface, when viewed without magnification, should be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining should be limited to no more than 33% of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease should be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP6/NACE 3.

SSPC-SP7/NACE 4 – BRUSH-OFF BLAST CLEANING

A Brush-Off Blast Cleaned surface, when viewed without magnification, should be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Mill scale, rust, and coating are considered adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed. Before blast cleaning, visible deposits of oil or grease should be removed by any of the methods specified in SSPCSP1 or other agreed upon methods. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP7/NACE 4.

SSPC-SP10/NACE 2 – NEAR-WHITE BLAST CLEANING

A Near-White Blast Cleaned surface, when viewed without magnification, should be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5% of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease should be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP10/NACE 2.

SSPC-SP11 – POWER TOOL CLEANING TO BARE METAL

Metallic surfaces that are prepared according to this specification, when viewed without magnification, should 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 portions of pits if the original surface is pitted. The profile shall not be less than one mil. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed-upon methods. For complete instructions, refer to Society of Protective Coatings Surface Preparation Specification No.11.

SSPC-SP12/NACE 5 – HIGH AND ULTRA-HIGH

Pressure Water Jetting for Steel and Other Hard Materials

This standard provides requirements for the use of high and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only, without the addition of solid particles in the stream. For complete instructions, refer to Joint Surface Preparation Standard SSPC-SP12/NACE 5.

SSPC-SP13/NACE 6 – CONCRETE

This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces, including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete and dust, and should provide a dry, sound, uniform substrate suitable for the application of protective coating or lining systems. (Depending upon the desired finish and system, a block filler may be required.) For complete instructions, refer to Joint Surface Preparation Standard SSPCSP13/NACE 6.

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POWDER PROBLEM SOLVER

APPLICATION PROBLEMS

1. Poor Penetration into Recessed Areas (Faraday Cage Effect)
- The Faraday Cage Effect occurs when surfaces closer to the gun attract the powder before it can penetrate into corners and recessed areas.
- Turn electrostatic settings down.
- Increase or decrease the powder delivery air setting.
- Check your ground. Hooks with heavy coating build up will become insulated from the part.
- Adjust powder spray pattern with different nozzles.
- Increase the powder feed velocity to penetrate the recessed area.
- Adjust gun placement, so powder cloud has more direct access to area.
- "High Fluidity" powders provide better penetration.

2. Inadequate Film Thickness
- Increase electrostatic setting.
- Adjust gun placement closer to the part and try different nozzles.
- Adjust part density (racking) so that powder can be attracted equally to each part.
- Excessive air velocity may be blowing powder past the part.
- Poor ground. Check your hooks.
- Excessive humidity may limit the charge on the powder particles.
- Powder may be too fine. Always maintain a consistent blend of virgin and recycled powder. Contact your Intella Customer Service Representative for a particle size analysis.
- Some powder technologies charge better or are meant to be applied as thin films. Contact your Intella Customer Service Representative

3. Back Ionization
- Back ionization occurs when powder layers start being repelled from the part during application.
- Turn electrostatic settings down.
- Excessive powder build up can cause back ionization. Lower powder feed rates and adjust gun distances.
- Check your ground.
- Having gun too close to the part.

4. Poor Fluidization in Hopper
- Air should be slowly percolating through the surface of the powder.
- Check your fluidizing membrane for plugged pores. Can be caused by moisture or oil in the air supply.
- Increase air pressure to fluidizer.
- Check for packed powder by stirring manually with a paddle or air.

5. Powder Blowing Out of Hopper
- Lower air pressure in fluidizing hopper.
- Powder may be too fine. Consult your Intella Customer Service Representative for a particle size analysis.
- Check hopper for proper venting.

6. Geysering
- Geysering is caused by air blowing holes through the surface of the fluidized powder.
- Lower air pressure to the fluidizer.
- Add more powder. Hopper should be about ¾ full when fluidizing.
- Check for plugged pores or other obstructions in membrane.
- Powder may be packed or moist. Check air supply for contaminants.

7. Impact Fusion
- Impact Fusion is the hard build up of powder particles that occurs in hoses, tubes and nozzles. Clean and replace tubes, hoses, venturi pumps, and nozzles on a regular basis.
- Powder may be too fine. Reduce your reclaim.
- Excessive air pressures and powder feed rates will increase the amount of impact fusion.

Check air supply for contaminants.

8. Surging or Inconsistent Powder Flow
- Increase air pressure and/or volume of air.
- Check powder hoses for kinks or obstructions. Keep hose length to a minimum. May need to replace powder hose with a smaller inside diameter hose.
- Clean all tubes, hoses and guns of impact fusion build up.
- Check powder delivery and air pressure settings.
- Check hopper for powder level and fluidization.
- Check air supply for contaminants.
- Excessive temperature and humidity in application area can cause application problems.
- Check for sintering or clumping in powder.

9. Poor Spray Patterns or Powder Feed
- Replace worn feed tubes, orifices, and deflectors in spray guns.
- Clean impact fusion from areas of accumulation.
- Increase powder feed (see section 8)
- Choose correct nozzle for part configuration.

10. Powder Drift From Spray Booth
- Clean or replace filter cartridges and final filters.
- Check pulse air pressure and for contaminants in air supply.
- Excessive drafts or pressure from outside the spray area causing turbulence.
- Using excessive amounts of compressed air during clean up.
- Insufficient air volume or velocity in recovery/reclaim.
- Excessive amount of fines.
- Part temperatures in excess of 110˚F may produce a "chimney effect".
- If guns are added to a booth or flows are run at their maximum it may exceed the filter surface capacity and lead to powder migration out of the booth. Decrease flow rates.

11. Spitting and Dry Spray of Metallics
- Spitting is caused by particles collecting on the diffuser and electrode.
- Periodically clean the electrode with air and adjust KV's and powder delivery.
- To reduce dry spray, adjust KV's and lower delivery volume and powder velocity.
- Control film thicknesses for more consistent color.
- Check KV Output at the gun.

FILM PROPERTY PROBLEMS

12. Excessive Orange Peel
- Adjust film thickness to recommended range. Consult your Intella Customer Service Representative.
- Lower the electrostatic settings on the equipment.
- Some powder coatings are formulated and manufactured to tighter, more controlled particle size distribution allowing for a smoother film.

13. Color Contamination
- Clean feed and spray systems completely before color changes (cross contamination).
- Dedicated powder hoses (and feed hoppers) can reduce the chance of contamination.

14. Off Color Film
- Examine application procedures to determine if variations in film thickness are causing the problem.
- Evaluate time at peak metal temperature, to determine if the parts have been over cured.
- Check oven exhaust.
- If the powder is off color, please contact your Intella Customer Service Representative.

15. High Gloss
- When applying a semi-gloss or flat coating and it appears that the gloss is too high after coming out of the oven, check oven settings and part temperatures. This is usually an indication of under cured powder.

16. Low Gloss
- Check oven and part temperatures to determine if the part has been over cured.
- Always make sure powder coatings are compatible before mixing.
- Check for microscopic pinholing or outgassing (see section 18).

17. Variations in Film Thickness
- Check application patterns and gun set-ups.
- Could be caused by surges in the powder flow (see section 8).
- Turbulence in the booth air flow.

18. Pinholing/Outgassing
- Usually caused by air or moisture being trapped in porous metal or castings.
- Pre-heat parts before applying powder, or bake at a slower rate.
- Use powder coatings that are formulated to be more forgiving for outgassing.

19. Edge Pull, Craters
- Poor surface preparation can cause voids and craters in a coating.
- Excessive phosphate residues on edges can create edge pull.
- Check dry-off oven for residual moisture on parts.
- Extremely smooth powder coatings may exhibit more edge pull due to the flow of the coating.
- Increase electrostatic settings for more edge coverage.

20. Poor Hardness and Abrasion Resistance
- Always know part temperatures and times to avoid under curing the coating. Either increase the oven temperature or extend the time in the oven.
- Determine Cure through the Solvent Rub Test.

21. Poor Corrosion Resistance
- Check your pretreatment system for cleaning effectiveness. Evaluate phosphate coating weights along with total dissolved solids levels in rinse tanks.
- Evaluate total film thickness to determine most effective level for the end environment.
- Always know peak metal temperatures and total time at that temperature to avoid under curing the coating.

22. Lack of Flexibility and Adhesion
- Usually caused by under curing.
- Check pretreatment system for cleaning effectiveness. Evaluate phosphate coating weights along with total dissolved solids level in rinse tank.
- Check for excessive total film thickness.

23. Color Shift in Metallics
- Changes in gun to part distance and electrostatics will change the orientation of the metal flake within the coating, causing color shift.
- Increasing the KV may darken color.
- Decreasing the distance may darken color.
- Increasing the distance may lighten color.
- Decreasing the KV may lighten color.
- Changes in the powder delivery rate and total film thickness will also affect color. Control both factors.
- Dry blended powders may stratify.
- Higher metallic concentrations can lead to short circuits in powder delivery system.
- Frequently purge the gun with air to maintain a clean tip.