



SPI Coating System Application Procedures

bhpbilliton

Insulation and Corrosion Protection System for Hot Pipes and Vessels

Prepared for BHP Billiton

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PART 1 - GENERAL

1.1 Purpose.

- A. This specification covers the preparation of surfaces and application procedures for coating hot pipes and vessels to provide insulation and to offer personnel protection and safety and corrosion under insulation (CUI) remedy and protection.

1.2 System Description.

- A. Insulation: HPC® Coating is a water-borne system using a special acrylic/urethane blend with specific ceramic compounds to provide a non-conductive block against heat transfer. HPC® Coating is designed to create a monolithic insulation system that can be sprayed over most types of surfaces and over surfaces with temperatures from ambient to 700 degrees F.
- B. Corrosion Protection: Rust Grip® is a one-part polyurethane, metallic pigmented coating that absorbs atmospheric moisture to cure. Rust Grip® is a protective coating film of superior adhesion, flexibility, abrasion, and impact resistance. When applied directly to the surface of the pipe, Rust Grip® penetrates into the pores of the metal substrate and seals the surface from moisture penetration and air infiltration and prevents corrosion. When applied over HPC® Coating, Rust Grip® seals the surface of HPC® Coating from moisture penetration and air filtration and provides a tough, hard membrane for protection from impact.
- C. Protective Water Proof Topcoat: SP Liquid Membrane™ is a tough, one-part elastomeric hydrocarbon, aliphatic polyurethane coating that provides a protective coating film of superior adhesion and flexibility and is resistant to abrasion and impact. When applied over HPC® Coating and Rust Grip®, SP Liquid Membrane™ seals the surface from moisture penetration and air filtration and provides a flexible membrane for protection from impact.

1.3 Handling, Storage, and Safety.

- A. All materials delivered to job-site shall be in original sealed and labeled containers of Superior Products International II, Inc. ("SPI"), the coating manufacturer.
- B. All coatings shall be stored in facilities designed for the purpose of coating storage and mixing. Storage areas shall be located away from open flames, be well ventilated, and be capable of maintaining ambient storage temperature as recommended by SPI.

- C. Coatings, reducing agents, and other solvents must be stored in original containers until opened. If not re-sealable, then they must be transferred to UL approved safety containers.
 - D. Provide proper ventilation, personal protection, and fire protection for storage before, during, and after application.
- 1.4 Environmental Requirements.
- A. Coatings shall be applied in an enclosed area or during good weather.
 - B. Surface temperature shall be at least 5 degrees F above dew point.
 - C. Coatings shall have no exposure to freezing temperatures after application {day or night) until fully cured. Applicator must consider temperature and wind-chill factor.
 - D. Air and surface temperatures shall be within limits prescribed by SPI for the coating being applied and work areas shall be reasonably free of airborne dust at the time of application and while coating is drying.

PART 2 - EQUIPMENT

- 2.1 HPC® Coating.
- A. HPC® Coating must be applied by airless spray except in circumstances where the surface area is small and the purpose is to repair a previous application of HPC® Coating.
 - B. Recommended spray equipment is Graco TexSpray RTX 1500, Graco TexSpray GTX 2000, texture hopper gun, or equivalent using a 2-4 mm nozzle.
 - C. For repair procedures, HPC® Coating may be applied by hand or with a putty knife.
- 2.2 Rust Grip®.
- A. Rust Grip® may be applied by soft bristle brush, one quarter inch ($\frac{1}{4}$) nap roller made for solvent use, or airless spray.
 - B. Recommended spray equipment is a standard airless sprayer (1.5 gallons/minute at 3,300 psi) with carbon steel or titanium tip sized between .013-.017 tip.
- 2.3 SP Liquid Membrane™.
- A. SP Liquid Membrane™ may be applied by soft bristle brush, one half or three quarter inch ($\frac{1}{2}$ to $\frac{3}{4}$) nap roller made for solvent use, or airless spray.
 - B. Recommended spray equipment is a standard airless sprayer (2.0 gallons/minute at 3,300 psi) with carbon steel or titanium tip sized between .037-.039 tip.
- 2.4 Other Equipment Requirements.
- A. The applicator's/contractor's coating equipment shall be designed for application of materials specified and shall be maintained in first class working condition.

- B. In accordance with requirements set forth by regulatory agencies applicable to the oil production industry, the manufacturer's printed Instructions, and appropriate technical bulletins, the contractor shall provide and require use of protective life-saving equipment for persons working in or around the project site.
- C. Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof.
- D. Ventilation shall reduce the concentration of air contaminants to the degree that a hazard does not exist.

PART 3 - EXAMINATION

3.1 Examination.

- A. All structural repairs must be made before preparation of surface and application of product begins.
- B. Thoroughly examine surfaces scheduled to be coated prior to commencing work.
- C. Report in writing to BHP Billiton's representative any condition that may affect proper application and overall performance of the coating system.
- D. Do not proceed with work until such conditions have been corrected.
- E. Commencing with work Indicates acceptance of existing conditions and responsibility for performance of applied coating.

3.2 Surface Preparation.

- A. For new pipes and vessels with an uncoated, bare metal surface.
 - 1. This standard requires SSPC-SP1, SSPC-SP2, and/or SSPC-SP3 Surface Preparation depending upon the condition of the surface.
 - 2. Surface shall be free of all previously existing visible rust, mill scale, dirt, contaminants, and foreign matter and have a matte metal finish.
 - 3. Surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previously existing visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings, and foreign matter.
 - 4. Surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.
- B. For new pipes and vessels with a painted metal surface.
 - 1. This standard requires SSPC-SP1, SSPC-SP2, and/or SSPC-SP3 Surface Preparation depending upon the condition of the surface.
 - 2. Surface shall be free of all previously existing visible rust, mill scale, dirt, contaminants, and foreign matter and have a matte finish.
 - 3. Surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previously existing visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings, and foreign matter.

4. If applied over an existing coating having a glossed or shiny finish, the surface must be sanded and roughed to remove gloss before application, to improve the profile.
 5. Surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.
- C. For old pipes and vessels with an uncoated, bare metal surface.
1. This standard requires SSPC-SP1, SSPC-SP2, SSPC-SP3, or SSPC-SP12 / NACE 5 Surface Preparation depending upon the condition of the surface.
 2. Surface shall be free of all previously existing visible rust, mill scale, dirt, contaminants, and foreign matter and have a matte metal finish.
 3. Surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previously existing visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings, and foreign matter.
 4. Surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.
- D. For old pipes and vessels with a painted metal surface.
1. This standard requires SSPC-SP1, SSPC-SP2, SSPC-SP3, or SSPC-SP12 / NACE 5 Surface Preparation depending upon the condition of the surface.
 2. Surface shall be free of all previously existing visible rust, mill scale, dirt, contaminants, and foreign matter and have a matte finish.
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 4. If applied over an existing coating having a glossed or shiny finish, the surface must be sanded and roughed to remove gloss before application, to improve the profile.
 5. Surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.
- E. Because the surface temperature of the hot pipe or vessel will increase after the application of HPC® Coating, the temperature limitations of any existing paint on the surface must be determined, and the existing paint must be completely removed from the surface if the increase in surface temperature will exceed the maximum temperature limitations of the existing paint.
- F. Surfaces are to be tested for salt contamination. Chlor-Rid or an equivalent is to be used as directed if salts are present.
- G. Surface must be completely dry and clean. Very Important.



PART 4 - APPLICATION INSTRUCTIONS

4.1 HPC® Coating.

- A. Prior to application of HPC® Coating, the coating shall be mixed with a commercial drill and a 6" diameter dispersion blade at low or medium speed for four (4) minutes to loosen product. HPC® Coating will initially look dry and have a "cake-like" appearance. Mechanically stir using blade until water and resins are mixed and coating appears as a thick whipped cream with no lumps. Use an up and down pumping motion while stirring. If HPC® Coating still appears to be dry, slowly add water while continuing to mix. In a 5-gallon pail, a maximum totaling 1 quart (1 liter) of water may be added as needed to achieve the desired consistency.
- B. HPC® Coating shall be applied between 40 degrees F (5 degrees C) and 120 degrees F (49 degrees C) ambient. Applied HPC® Coating should never be put into use or exposed to below 40 degrees F (5 degrees C) until it is totally cured and moisture has evaporated from coating. Use a moisture meter to determine moisture content. (three percent (3%) or less).
- C. Hot Surface Applications.
 1. Apply a thin priming coat of HPC® Coating at 50 mils wet (1.25mm) and allow coating to cure down and moisture to steam off. (Approx. 5 minutes) Once steaming has stopped, apply additional coats of HPC® Coating at 100-200 mils wet per coat (depending on surface temp) to build to specified thickness as recommended by SPI.
 2. Allow coating to completely steam off between coats before applying additional product. After proper thickness is achieved, allow 24 hours to fully dry and cure before top-coating. Rust Grip® or Enamo Grip can be used over HPC® Coating to strengthen surface or add color when specified.
 3. NOTE: If initial coat or additional coats are applied too thick, bubbles will appear and begin to rise. Bubbles can be punctured to release trapped air and pressed down to allow bubble to adhere.
- D. Cold Surface Applications:
 1. Apply a thin priming coat of HPC® Coating at 50 mils wet (1.25 mm) and allow to dry down by evaporation. Build desired thickness to the specified thickness recommended by SPI using several applications giving each coat time to mostly dry. (Approximately 4 hours at 70 degrees F (21 degrees C). Curing can be enhanced by introduction of dehumidification and heat into the surrounding environment.
- E. NOTE: In coating pipes where they extend through supports, apply at the specified thickness recommended by SPI over the surface of the pipe which will completely fill and seal the clearance gaps. Taper HPC® Coating around the clearance gaps to a distance of two to three inches so that the coating fills the gap completely, has a sufficient surface area to adhere to the support, and Rust Grip® and SP Liquid Membrane™ can be applied over the entire surface of HPC® Coating as it extends around the clearance gap to eliminate any potential seams or cracks for added protection.

F. HPC® Coating should not be used or exposed to below temperatures below 40 degrees F (5 degrees C) until it is fully cured and moisture has evaporated from the coating. Use a moisture meter to determine that the moisture content is three percent (3%) or less.

G. Use water to clean equipment.

4.2 Rust Grip®.

A. Prior to application of Rust Grip®, the coating shall be mixed by hand or with a power drill using low-medium speed with NO vortex. (A vortex will draw moisture into the coating.)

1. When the container is opened, the coating will be a yellowish green color. Mix continuously (with no vortex) until the entire surface of the coating turns a silver gray color. Once the coating color has turned completely silver-gray, mix for two more minutes making sure all paste is off of the bottom. Stirring this paste distributes the metallic pigments throughout the coating.

2. Rust Grip® should not be diluted or thinned.

3. NOTE: Once container is opened, the product must either be used completely, or sealed with visqueen/plastic before reattaching lid after use, or repackaged and sealed well in an unlined metal can. Product may thicken if left open in can. Pour off the amount you intend to use after proper stirring. If left open, the product will harden in the container.

B. Rust Grip® should not be applied over HPC® Coating until it is fully cured and moisture has evaporated from the coating. Use a moisture meter to determine that the moisture content is three percent (3%) or less.

1. NOTE: Before applying Rust Grip® over HPC® Coating on a hot surface, verify that the surface temperature of HPC® Coating is below 417.2 degrees F by using thermal imagery to mitigate the potential risk of the autoignition of Rust Grip®.

C. Rust Grip® must be applied in two coats over HPC® Coating at no less than a total of 8 mils wet/4 mils dry (200 square feet per gallon) per coat. It will take a minimum of two passes to achieve the minimum 8 mils wet. The second pass to achieve the necessary mil thickness must be applied once the first coat of Rust Grip® is tacky to the touch.

D. In all applications (brush or roller), apply at “half-speed” and use a cross-hatch method (side-to-side, then top-to-bottom) slowly to prevent pinholes and allow penetration.

E. Overcoat with Rust Grip® or other coatings immediately after surface is dry to the touch to achieve proper adhesion. Higher temperature and humidity will shorten curing times, lower temperatures will slow curing. The overcoat time, normally within 1 to 2 hours after reaching the dry-to-touch stage, will be determined in accordance with the project specifications. If product applied after the specified overcoat time, the surface will need to be lightly sanded to achieve good adhesion.

1. At high RH values of 60% or more, Rust Grip® cures very quickly and the window for applying another layer of coating is very short. At 85% RH, it could be determined that one has only an hour or less over-coat window depending on the ambient temperature. The higher the temperature, the faster solvents evaporate out of the coating. It is always best to overcoat immediately when the first coat of Rust Grip becomes dry to the touch. Since the curing process is so dependent on ambient temperature and RH, the physical touch-test is always the best approach when working in high humidity environments. RH of 60% and up.
- F. If breaks are taken, spray systems should be flushed with solvent. After completion, spray system should be flushed and cleaned with solvent. After completion, brushes and rollers should be discarded.

4.3 SP Liquid Membrane™.

- A. Prior to application of SP Liquid Membrane™, the coating shall be mixed by hand or with a power drill using low-medium speed. When the container is opened, the coating will be a clear solvent on top. Mix continuously until the entire surface of the coating turns a solid color. Once the coating color has turned completely uniform, mix for two more minutes making sure all paste is off of the bottom.
- B. SP Liquid Membrane™ should be applied over Rust Grip® after it is dry to the touch or at the “tack free” stage (a tacky surface, but does not transfer color when touched - no coating comes off when you press on it with your finger or thumb).
- C. SP Liquid Membrane™ must be applied in one coat at no less than at total of 7 mils wet/3 mils dry (225 square feet per gallon).
- D. In all applications (brush or roller), apply at “half-speed” and use a cross-hatch method (side-to-side, then top-to-bottom) slowly to prevent pinholes and allow penetration due to the coating film being too thin.
- E. If breaks are taken, spray systems should be flushed with solvent. After completion, spray system should be flushed and cleaned with solvent. After completion, brushes and rollers should be discarded. Unlike other types of rubber coatings, the application can start and stop using the steps above without the normal problems of the coating setting up in the hoses, gun and machine. It is very applicator-friendly.

PART 5 – REPAIR PROCEDURES FOR SPI COATING SYSTEM

5.1 General.

- A. The repair procedures for the SPI Coating System should be followed if the SPI Coating System has been removed from the surface of the pipe or vessel or from bolt heads or valves for visual inspection of the surface of the pipe or vessel or to perform repairs to the pipe or vessel or if the SPI Coating System has been damaged.



5.2 Removal of SPI Coating System.

- A. The SPI Coating System may be removed from the surface of a pipe or vessel by cutting the exterior surface of the coatings with a knife, box cutter, or other sharp instrument and scraping the coatings away from the surface to the extent necessary to conduct the visual inspection or repair or to remove any area of the SPI Coating System that has been damaged.

5.3 Re-Application of SPI Coating System.

- A. The area of the SPI Coating System to be repaired shall have all loose coating removed, shall be free of dirt, contaminants, and other foreign matter, and should be clean and dry.
- B. Depending upon the size of the area of the SPI Coating System to be repaired, HPC® Coating may be re-applied by hand, by putty knife, or by airless spray. HPC® Coating will adhere to itself and form a tight bond to the existing coating that was not removed or damaged during the repair process.
- C. After HPC® Coating has been re-applied and the surface of HPC® Coating is uniform without any gaps or breaks, then the application instructions for Rust Grip® and SP Liquid Membrane™ should be followed.

PART 6 – PROTECTION

6.1 Protection

- A. Diligence should be taken to ensure that vehicles, equipment, fixtures, miscellaneous hardware.
- B. Surfaces not to be coated will be marked, removed, or otherwise covered to protect against cleaning and coating application procedures and weather. Care shall be exercised to avoid lapping on glass or hardware. Finished surfaces shall be free from defects or blemishes.
- C. Protective coverings or drop clothes shall be used to protect floors, fixtures, and equipment.

PART 7 - INSPECTION

7.1 Inspection.

- A. After application of each coating in the specified system and its surface has cured, measure its thickness with a properly calibrated dry film thickness gauge. Follow standard method for measurement of dry paint thickness.
- B. Make as many determinations as needed to ensure the specified thickness are achieved and make adjustments to all surfaces having less dry film thickness than specified until the specified thickness is achieved.