Corrosion Services

OP-CC-GS-COAT-001

General Coating Specifications

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Part I
Above-Ground Facilities

Part I - Above Ground Facilities

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1 Introduction

1.1 Scope

This coating specification covers equipment, surface preparation, materials selection, coating application and inspection procedures for vessels, equipment, piping, and above ground structures.

In this document, any Boardwalk entity shall be referred to as “Company” and any service company that is contracted to apply a coating to an above ground metallic structure shall be referred to as “Contractor”.

2 General Procedures

2.1 Evaluation

As per the guidelines set out in DOT 192.481, each above ground pipeline, portion of pipeline, meter station piping, or compressor station piping exposed to the atmosphere, shall be evaluated using the *Atmospheric Corrosion Survey Visual Aid Guide* and the result of the evaluation shall be reported on the Operations Management System (OMS).

This evaluation shall be conducted by a designated Company representative who has been trained in conducting atmospheric corrosion inspections.

Any remediation work shall be prioritized and scheduled for completion in accordance with *TL8007 Atmospheric Corrosion Inspection*.

2.2 Lead-Based Coatings

Company Area Managers or designated Company representatives shall check for the presence of lead-based coatings before recoating. If lead-based coatings are present, the procedures for coating equipment with lead-based coatings shall be followed (see section 11).

2.3 Required Documentation

Coating Contractors shall have executed the Company's applicable service agreement(s). Contractors shall also document DOT compliance.

2.4 Notification of Area Managers

Area Managers (AMs) shall be notified by Contractor prior to starting scheduled work in their area of responsibility. Work shall be scheduled to minimize conflicts with Company operations.

2.5 Notification of Control Center

Company employee or designated representative shall notify Control Center of work schedule.

2.6 Company / Contractor Responsibilities

2.6.1 Prior to starting the work, Contractor/Inspector shall attend to the orientation training. It is the responsibility of the AM or supervisor to ensure that the personnel who performs, inspects or works in the area is properly trained in the use and operation of equipment, required personal protective equipment (PPE), proper personal hygiene practices, clean up, waste disposal, emergency plan and safety procedures.

2.6.2 Prior to commencement of work, a pre-job meeting shall be held among Contractor, Company, and Company's third-party inspection personnel to assure that all parties involved fully understand the scope of work, Job Plan, safety procedures and applicable requirements.

2.6.3 Areas to be painted shall be clearly identified by a Company representative. Use caution signs as needed. It is responsibility of the job supervisor to ensure that employees working in the close proximity to the job site are informed of existing hazards and appropriate measures are taken to ensure safe working conditions.

2.6.4 Contractor shall inform facility operators of all planned work activities for each day worked. All abrasive blasting activities inside the compressor stations shall be coordinated and approved by the Area Manager (AM). Abrasive blasting in the area will be allowed while the compressor units are running only if it does not interfere with the compressor operation and air intake quality is not affected.

2.6.5 If pipe is to be lifted from supports, pipes shall be lifted in accordance with Company's contract documents. If pipe is equipped with tie-down strap, Contractor shall notify a Company representative of its intent to remove the straps. Painted areas shall be checked by Company inspector. Teflon pads or other approved material / coating shall be placed between the pipe and pipe support before pipes are lowered into their supports. Straps shall be replaced and tightened to the proper degree of torque to prevent pipe movement during operation. Adjustable pipe supports with polymer U-bolt jacket and polymer support spacer are preferred. The polymer support spacer must be rounded to reduce contact surface area and must be capable of supporting the weight of the piping. The U-bolt support must have a polymer wrap to prevent any metal to metal contact between the support and the pipeline.

If required, additional impact/abrasion resistant barrier can be applied at the pipe support areas. Materials are specified in Section 7.1.

2.6.6 Contractor shall have and upon request provide to Company copies of Product Data sheets and MSDS for all materials furnished by Contractor.

2.6.7 If applicable, Contractor shall complete the Company's Pre-Job and Post-Job punch list for each site.

2.7 Contractor Materials

Contractor shall furnish all labor, equipment, brushes, scaffolding, enclosures, coating material (approved and included in this specification), solvents, etc. necessary to complete the work. Contractor shall supply all required and approved personal protective gear for abrasive blast cleaning and coating application.

2.8 Cleanliness

All work shall be accomplished in a neat and workmanlike manner. All phases of the cleaning and coating operation shall be subject to the approval of Company Inspector. The work area shall be kept clean and orderly. All empty containers, rags, sandpaper, and debris shall be removed each day from the work area. Contractor shall also clear the site of abrasive blast material accumulated as a result of surface preparation and place such material in a DOT approved container.

2.9 Protection of Assets

Contractor shall be responsible for protecting all buildings, structures and equipment from over blasting, abrasive blast / dust, over spray, paint droppings, or other damage. Contractor shall notify Boardwalk representative(s) prior to spray coating in areas where overspray may drift and settle on Company, visitor, employee, or public properties. In areas where overspray may present considerable risk to Contractor, building a containment around the structure to be painted will be required. Contractor shall be responsible for any cost associated with repair or replacement of private or Company property including, but not limited to, vehicles, facilities, or equipment that receives damage as a result of abrasive blasting, abrasive blast dust, paint spatter or over spray. All protective materials shall be removed at the completion of the project.

3 Surface Preparation

3.1 Items Not to Blast or Coat

3.1.1 Unless specifically noted, underground pipe wrap, concrete, transformers, valve stems, drive shafts, gauges, conduit, nameplates, stainless steel, galvanized, plastic, aluminum, glass, grease fittings or other non-corrosive surfaces shall not be blasted or coated.

3.1.2 Unless prior agreement or approval from a Company representative, metal surfaces not to be cleaned and coated include manufactured equipment finished with primer and/or finish coats such as pumps, motors, electrical control equipment enclosures, instrument cases, etc.

3.1.3 All mechanical and electrical equipment shall be protected from paint removal and paint application by thoroughly sealing all bearings, mechanical seals, instrument cases, switch housings, nameplates, etc**.**

3.2 Surface preparation before blast cleaning

3.2.1 All surfaces to be abrasive blasted or painted shall be clean of any visible dirt, loose paint, oil, grease, and foreign material in accordance to SSPC-SP-1.

3.2.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatters, or burning slag should be removed from the surface.

3.3 Abrasive Blast Cleaning

3.3.1 All metal surfaces, except those specifically exempted in these specifications, are to be abrasive blasted to a degree of cleaning and anchor profile in accordance with the requirements in section 6.

3.3.2 All blasting shall be scheduled in a manner that will enable coatings to be applied in accordance with the manufacturer’s recommendations.

3.3.3 The abrasive size, shape and type (grade) used shall be appropriate to produce the degree of cleaning and anchor profile specified.

3.3.4 The blasting material shall be dry and free of oil, grease, and other contaminants.

3.3.5 Clean dry compressed air shall be used for nozzle blasting. Moisture separator, oil separators, traps or other equipment may be necessary to achieve this

requirement. Contractor shall verify the cleanliness of each compressed air supply daily by performing the blotter test in accordance with ASTM D4285.

3.3.6 Blasting shall be performed in an area away from painting operations and freshly coated surface to prevent dust and sand contamination.

3.3.7 Blasting shall be done during daylight hours and surface shall not be wet after blasting or before painting. Prime any bare steel within eight (8) hours or before flash rusting occurs. If blasting is allowed during the day before prior to company approval, the surface shall be swept cleaned (SSPC-SP-7) next day prior to the coating application.

3.3.8 Power tools, as specified in SSPC-SP-3 or SP-11, may be used to prepare small areas or metallic surface of sensitive equipment where abrasive blasting is not possible. Please see Table 6 for specific surface preparation requirements.

3.4 Surface preparation after blast cleaning

3.4.1 After blast cleaning, dust and loose residues shall be removed from prepared surface by brushing, blowing off with clean dry air or vacuum cleaning.

3.4.2 In order to prevent surface contamination, all containment used for lead abatement or coating removal shall be removed prior to application of coating.

3.5 Surfaces with Oxidized Layers

Where applicable, Contractor shall remove oxidized layers of factory-applied paints or primers by screening or other acceptable means, before finish is applied in field.

3.6 Rust and Corrosion

All primed metal surfaces showing any trace of rust or corrosion shall be thoroughly abrasive blasted to bright metal and a primer coat applied to specified thickness.

4 Application

4.1 Manufacturer's Recommendations

Current manufacturer's recommendations for mixing, thinning, pot life, and coating application should be obtained, reviewed and used unless approved otherwise by the Corrosion Services Department. Any deviation from recommended practices shall be reviewed and approved by the Corrosion Services Manager or designated representative.

4.2 Conditions When Coating Shall Not Be Applied

Contractor shall not apply coating during dusty, threatening or rainy weather, foggy days, or when ambient temperature is not within the coating manufacture's recommended application temperature range. The substrate temperature must be a minimum of 5^{o}F above the dew point temperature. No coating shall be applied when relative humidity is above eight-five (85%) percent, or wind velocity is above fifteen (15) mph.

4.3 Coating Application

Surface shall be clean and dry before coating application. Application of primer shall be made the same day metal is abrasive blasted. If this is not possible, and with Company approval, the primer may be applied the next day after surface preparation. In this case, the surface shall be sweep blasted to remove any rust-back formation. All coating shall be applied to uniform thickness and shall be entirely free of runs, sags, contaminates or holidays

4.4 Sanding

Sanding between coats may be necessary to achieve a smooth glossy finish. Company inspector shall determine if sanding is necessary.

4.5 Additional Primer Coating Application

Primer maybe applied in smaller segments with a one (1') foot overcoat on the previously applied primer. The top coat must be applied in one continuous coat over the entire structure.

4.6 Stripe Coating Application

Each application of coating material shall be worked into corners, welds, crevices, joints, etc. and distributed evenly over all surfaces. Stripe coats (brushed) shall be applied on difficult to reach areas and all areas where sharp edges are present prior to the first coat application.

4.7 Color Contrast of Coatings

When two or more coats are to be applied, the coats shall have a slight deviation in color to contrast with the succeeding coat. Usually different color for primers and top coats are specified.

4.8 Drying

Sufficient time must be allowed between coats for thorough drying. Drying time depends on weather conditions and the characteristics of the selected coating. In all cases, drying time shall follow the manufacturer's specifications.

4.9 Spray Application

4.9.1 All spray techniques and equipment used shall be in accordance with the coating manufacturer's recommendations.

4.9.2 Always purge/clean spray equipment before each use with the reducer/solvent recommended by manufacturer.

4.9.3 An adequate moisture trap shall be placed between the air supply and pressure feed to gun. The trap shall continually bleed off any water or oil from the air supply.

4.9.4 Separate regulators shall be used to adjust the paint pot pressure and atomization pressure. Each regulator shall be provided with a pressure gauge operating properly at all times.

4.9.5 Atomizing air and paint pot pressure shall each be regulated to the minimum amount required to properly atomize material for application without dry spray, runs or sags. If a particular coating system requires special pumps or equipment, only that specific equipment will be acceptable for coating application.

4.9.6 Keep the spray gun at the minimum suitable distance (10-12 inches) from the work piece, spraying consistently at 90° to the surface that is being painted.

4.9.7 Use fifty (50%) percent overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at right angle.

4.10 Alternative Coating Application Procedures

All coatings shall be spray applied except in areas where spray application in restricted or when a prior agreement has been reached to use an alternative application procedure.

4.11 Brush/Roller Application

4.11.1 Brush or Roller application is only allowed for repairs or touch-up of small areas, where spray application is no possible.

4.11.2 The coating should be applied with a suitable medium china bristle brush or short-nap mohair roller cover with phenolic core. Do not use synthetic bristled brushes.

4.11.3 Extra care should be taken to measure and hold film thickness when applied by brush and roller.

4.11.4 Roller where applicable, shall be restricted to flat or curved surfaces free from numerous rivets, edges, interior angles, deep pits, welds, and similar irregularities, except when supplemented by brushing. Avoid excessive re-brushing or re-rolling.

5 Inspection

Unless otherwise approved by Company, a Company inspector shall examine all prepared surfaces and previously coated areas and verify that the work meets coating specification before and after Contractor applies the primer coat or additional coats. Drying time and recoat schedule shall meet the manufacturer's published recoat schedule.

5.1 Surface Preparation

Contractor shall verify the anchor pattern profile using an approved measurement tape and dial indicator gauge (replica tape test) or digital profile gauge (ASTM D 4417). A set of the most recently issued NACE Standard or SSPC surface profile comparators, or equivalent, can also be used to determine and compare surface profile or anchor pattern. The resultant anchor profile shall be within the specified range.

5.2 Paint Coverage

Paint coverage shall be designed to provide the dry film thickness (DFT) specified in the Coating Schedule. Where thickness is not called out in these specifications, paint coverage shall be within the minimum and maximum thickness per the manufacturer's recommendations.

5.3 Measuring Film Thickness

Dry film thickness measurements shall be made randomly using a properly calibrated Type II constant pressure probe gauge. The calibration shall be in accordance with the manufacturer's recommendation and using calibrated test equipment per standard procedure recommended by the National Institute of Standards and Technology (NIST). The applicator shall show proof of the calibration certification. The applicator shall check the coating thickness with wet and dry film thickness gauges in accordance with SSPC-SPA2 requirements.

Each DFT reading shall be at least eighty (80%) percent of the specified minimum thickness and less than one hundred and twenty (120%) percent of the specified maximum thickness. The average of the three DFT readings constitutes a spot measurement. The spot measurement must fall within the specified DFT range as listed in the manufacturer's product data sheet and/or this specification. Both spot readings and DFT average shall be reported. Spot and area measurements shall be in conformance with the below procedure.

Spot measurement:

The average of three gage reading made within 1.5 inch diameter circle.

Area Measurement:

The average of five randomly spot measurements for each 100 square feet of coated surface.

The number of areas depend on the size of the coated surface:

- **Less than 300 square feet**, every 100 square foot area must be measured for coating thickness.
- **300 to 1,000 square feet**, three random areas are selected and measured.
- **Areas exceeding 1,000 square feet,** three random areas are selected from the first 1,000 square feet, plus one additional area for each additional 1,000 square feet

5.4 Using Type I Dry Film Thickness Gauges

Type I pull off gauges are acceptable, but Contractor shall have certification of calibration on hand. Proof of accuracy using certified calibration blocks, may be requested by Company representative.

5.5 Additional Applications

In the event the dry film thickness is below the minimum specified, additional applications shall be made using the same application procedures, until specified DFT requirements are met. If the maximum re-coat interval is exceeded, the applied coating surface shall be abraded for proper coating adhesion.

5.6 Poor Workmanship

Work shall be rejected in cases of poor workmanship. Poor workmanship includes, but is not limited to inadequate drying or curing, dirt/dust inclusions, contamination of any type, over spray, pinholes, runs, sags, holidays, lack of gloss, or low DFT.

5.7 Acceptable Finish Conditions

The entire coating surface shall be free of abrasions, holidays, and shall be uniform in color, gloss, and appearance.

6 Coating Specifications for Above Ground Facilities

Table 6 provides a quick reference that includes the coating systems recommended for the external corrosion protection of above ground assets. The systems are classified based on the service environment, operation temperature, scope and surface preparation requirements.

Table 6: Coating Systems for Above Ground Steel Surfaces

Service	System	Operating Temp	Scope	Surface Prep
Onshore Applications: structural steel, skids, pipe supports, platform decks and framing, piping, valves, pig traps, vessels, pumps, tank exteriors	A1	Up to 200°F	New and recoat	SSPC-SP-6
			Overcoat	SSPC-SP-7
			Spot Repair (touch-up)	SSPC-SP-2 or SSPC-SP-3
	A2	Up to 200°F	Field Touch-up	SSPC-SP-2 or SSPC-SP-3
Offshore Applications: structural steel, skids, pipe supports, platform decks and framing, piping, flanges, valves, pig traps, vessels, pumps, tank exteriors	B1	Up to 200°F	New and recoat	SSPC-SP-6
			Overcoat	SSPC-SP-7
			Spot Repair (touch-up)	SSPC-SP-2 or SSPC-SP-3
Splash Zones Applications: piling, main decks areas in platforms, under deck areas	B2	140°F -180°F	New and recoat	SSPC-SP-10
			Spot Repair (touch-up)	SSPC-SP-10 SSPC-SP-12 or SSPC-SP-11
Hi-Temperature (with and without Thermal insulation) Applications: Stacks, heaters, compressors, turbines, pumps, manifolds, process vessels	C1	200°F-500°F	New and recoat	SSPC-SP-10
			Spot Repair (touch-up)	SSPC-SP-10 or SSPC-SP-11
	C2	400°F-1200°F	New and recoat	SSPC-SP-10
			Spot Repair (touch-up)	SSPC-SP-10 or SSPC-SP-11

New: bare substrate that never has been put in service or coated
Recoat: removal of existing coating to bare substrate
Overcoat: application of new coating over existing coating
Spot Repair (touch-up): repair of existing coating

6.1 System A1 – Onshore Service – Steel Surfaces up to 200°F

Coating Systems recommended for corrosion protection of above ground onshore steel structures operating at temperatures up to 200°F are specified in Table 6-1. Products from different manufacturers are included. Any deviation shall be reviewed and approved by the Corrosion Services Manager or designated representative prior to application.

Table 6-1: Coating Systems for Onshore Service-Steel Surfaces up to 200°F

Manufacturer	Carboline	Denso	SPC	Sherwin Williams	PPG
Primer					
Name/Number	Carboguard 890	Archco 300	SP-5885 SF	Macropoxy 646 Series	Amercoat 385 or Amerlock 2/400
DFT	6-8 mils	4-8 mils	8-12 mils	5-10 mils	6-8 mils
Color	Buff, white, red	Beige/red	Various	White, red	Light buff, white, red
Finish Coat					
Name/Number	Carbothane 134 (a) or Carboxane 2000 (b)	Archco 65	SP-1088	Acrolon 218 HS or Hi-Solids Polyurethane	Pitthane Ultra Polyurethane
DFT	2-4 mils (a) 5-7 mils (b)	3-5 mils	2-3 mils	3-6 mils	2-3 mils
Color	Table 9-1	Table 9-1	Table 9-1	Table 9-1	Table 9-1

(a) If Carbothane 134 is applied as top coat, the coating DFT specified: 2-4 mils

(b) If Carboxane 2000 is applied as top coat, the coating DFT specified: 5-7 mils

6.1.1 New and Recoat

Surface preparation:

- Solvent cleaning in accordance with SSPC-SP-1
- Abrasive blasting in accordance with SSPC-SP-6, Anchor Profile: 2-3 mils.
- Dust and loose residues shall be removed from prepared surface prior to coating application.

Coating Application:

See Table 6-1 for specific manufacturer, products, and coating thickness (DFT).

6.1.2 Overcoat

Overcoat is a good maintenance option for aged coatings that are still in sound condition with good adhesion to the metal surface (e.g., no disbondment, cracking or delamination). For additional coat application, the existing paint must attain a minimum 3A rating in accordance with ASTM D3359 “X-Cut” adhesion test. Surface to be overcoated shall be Sweep Blast Cleaned, removing any chalky residues, corrosion products or loose paint. A test patch is recommended to confirm compatibility and adhesion with existing coating. For better compatibility, the application of a universal primer may be required prior to the application of the coating system specified in Table 6-1. Please consult manufacturer for product recommendations.

Surface preparation:

- Solvent cleaning in accordance with SSPC-SP-1.
- Abrasive blasting in accordance with SSPC-SP-7 (Brush Off).
- Dust and loose residues shall be removed from prepared surface prior to coating application.

Coating Application:

Apply any of the coating system specified in Table 6-1.

- Primer: 4-6 mils
- Top coat: DFT as specified in Table 6-1

6.1.3 Spot Repair (touch-up)

Small areas, where blasting is impractical or not permitted, may be repaired using Hand or Power Tool Cleaning according to SSPC-SP-2 and/or SSPS-SP-3. If the prime coat has not been damaged, clean the surface down to the prime coat followed by application of the top coat as specified in Table 6-1. Areas where the prime coat is damaged shall be cleaned down to the metal surface and recoated applying the coating system specified in Table 6-1.

. **Surface Preparation:**

- Surface must be solvent cleaned according to SSPC-SP-1.
- After solvent cleaning, the surface shall be prepared, as a minimum, per the Hand Tool (SPC-SP-2) or the Power Tool Cleaning specification (SSPC-SP-3). All loose coating and corrosion products must be removed from the surface.
- The coating adjacent to the damaged coating area must be feathered and lightly sanded for a minimum distance of 1 inch to ensure adequate adhesion between the old coating and the new coating.
- Dust and loose residues shall be removed from prepared surface by brushing, blowing off with clean dry air or vacuum cleaning prior to coating application.

6.2 System A2- Field Touch-up (Small Repairs) for Onshore Service- Steel Surfaces up to 200ºF

Additional coatings options are listed in Table 6-2 for field re-touches. These are single component products (single container) for easy application, so they are an alternative option for maintenance or touch-up of small areas. The use of the products is exclusively limited to minor coating repairs or paint re-touches on above ground piping, valves and flanges with coating defects that do not exceed 12 inches in diameter (damage size), unless specifically authorized by the Corrosion Services Manager.

For all coating defects exceeding 12 inches in diameter or any surface with corrosion condition rated as 3 or 4, abrasive blasting (SSPC-SP-6) and re-coat will be required per Section 6.1.1.

Surface Preparation:

- Surface must be solvent cleaned according to SSPC-SP-1.
- After solvent cleaning, the surface shall be prepared, as a minimum, per the Hand Tool (SPC-SP-2) or the Power Tool Cleaning specification (SSPC-SP-3). All loose coating and corrosion products must be removed from the surface.

- The coating adjacent to the damaged coating area must be feathered and lightly sanded for a minimum distance of 1 inch to ensure adequate adhesion between the old coating and the new coating.
- Dust and loose residues shall be removed from prepared surface by brushing, blowing off with clean dry air or vacuum cleaning prior to coating application.

Coating Application:

See Table 6-2 for specific manufacturer, products, and coating thickness (DFT).

Table 6-2: Field Touch-up (Small Repairs). Steel Surfaces up to 200ºF

Manufacturer	Carboline	Sherwin Williams	PPG
Primer			
Name/Number	Carbocrylic 3359 DTM	Pro Industrial Acrylic DTM	Pitt-Tech Plus
DFT	3-5 mils	2-4 mils	2-4 mils
Finish coat			
Name/Number	Carbocrylic 3359 DTM	Pro Industrial Acrylic DTM	Pitt-Tech Plus
DFT	3-5 mils	2-4 mils	2-4 mils
Color	Table 9-1	Table 9-1	Table 9-1

DTM (Direct to Metal): grades can be applied direct to metal as a primer and finish coat

6.3 System B1- Offshore Service- Steel Surfaces up to 200ºF

Coating Systems recommended for corrosion protection of offshore steel structures exposed to atmospheric corrosion, operating at temperatures up to 200ºF are specified in Table 6-3. This specification applies to any atmospheric assets operating in brine areas, facilities close to lakes, rivers, coastal areas and offshore platforms. Options from different manufacturers are included. Any deviation shall be reviewed and approved by the Corrosion Services Manager or designated representative prior to application.

Table 6-3: Coating Systems for Offshore Service-Steel Surfaces up to 200ºF

Manufacturer	Carboline	Hempel	Sherwin Williams	PPG
Primer				
Name/Number	Carboguard 635	Hempadur Avantguard 750	Macropoxy 646 Series	Amerlock 2/400
DFT	4-6 mils	4-6 mils	4-6 mils	4-6 mils
Color	Buff, white, red	Dark Gray	White, buff	Light buff, white, red
Intermediate Coat				
Name/Number	Carboguard 635	Hempa Prime Multi 500	Macropoxy 646 Series	Amerlock 2/400
DFT	4-6 mils	4-6 mils	4-6 mils	4-6 mils
Color	Buff, white, red	Red, black, orange	White, buff	Light buff, white, red
Top coat				
Name/Number	Carbothane 134 (a) or Carboxane 2000 (b)	Hempathane HS 55610 or Hempaxane Light 55030	Acrolon 218 HS or Hi-Solids Polyurethane	Pitthane Ultra Polyurethane
DFT	2-4 mils (a) 5-7 mils (b)	3-4 mils	2-4 mils	2-3 mils
Color	Table 9-1	Table 9-1	Table 9-1	Table 9-1

(a) If Carbothane 134 is applied as top coat, the coating DFT specified: 2-4 mils

(b) If Carboxane 2000 is applied as top coat, the coating DFT specified: 5-7 mils

6.3.1 New and Recoat

Surface preparation:

- Solvent cleaning in accordance with SSPC-SP-1.
- Abrasive blasting in accordance with SSPC-SP-6, Anchor Profile: 2-3 mils.
- Dust and loose residues shall be removed from prepared surface prior to coating application.

Coating Application:

See Table 6-3 for specific manufacturer, products, and coating thickness (DFT).

6.3.2 Overcoat

Overcoat is a good maintenance option for aged coatings that are still in sound condition with good adhesion to the metal surface (e.g., no disbondment, cracking or delamination). For additional coat application, the existing paint must attain a minimum 3A rating in accordance with ASTM D3359 “X-Cut” adhesion test. Surface to be overcoated shall be Sweep Blast Cleaned, removing any chalky residues, corrosion products or loose paint. A test patch is recommended to confirm compatibility and adhesion with existing coating. For better compatibility may be required the application of a universal primer prior to any coating system specified in Table 6-3. Please consult manufacturer for product recommendations.

Surface preparation:

- Solvent cleaning in accordance with SSPC-SP-1.
- Abrasive blasting in accordance with SSPC-SP-7 (Brush Off).
- Dust and loose residues shall be removed from prepared surface prior to coating application.

Coating Application:

Apply any of the coating system specified in Table 6-3.

- Primer: 4-6 mils
- Topcoat: DFT as specified in Table 6-3

Note: For field applied coating projects (assets exposed to marine environments), high pressure wash adding salt-removing chemical is recommended prior to abrasive blasting. After abrasive blasting, surface shall be tested for salt content. The substrate shall not contain chlorides in excess of 5 ppm. If chlorides concentration exceeds this value, the surface will require additional chemical cleaning, followed by water rinse (fresh waterjetting). Allow the surface to dry and re-test for salt content. Once decontamination is complete, a final dry blasting will be required prior to the coating application. Apply coating as soon as possible to avoid flash rusting and salt contamination.

Note: For those coating systems requiring two or more coats, water rinse between coats will be required to remove salts and other contaminants from surface.

Note: Pitted steel generally is subjected to more abrasive blast cleaning repetitions or dry abrasive blast cleaning/water wash cycles to decontaminate the surface to acceptable levels.

6.3.3 Spot Repair (Touch-Up)

Small areas, where blasting is impractical or not permitted, may be repaired following the procedure described below. If the prime coat has not been damaged, clean the surface down to the prime coat followed by application of the top coat as specified in Table 6-3. Areas where the prime coat is damaged shall be cleaned down to the metal surface and recoated applying the coating system specified in Table 6-3.

Surface Preparation:

- Remove oil, grease and salt contaminants from surface by high pressure fresh wash cleaning adding salt removing chemical (SSPC-SP-1).
- After solvent cleaning, the surface shall be prepared, as a minimum, per the Hand Tool (SPC-SP-2) or the Power Tool Cleaning specification (SSPC-SP-3). All loose coating and corrosion products must be removed from the surface.
- The coating adjacent to the damaged coating area must be feathered and lightly sanded for a minimum distance of 1 inch to ensure adequate adhesion between the old coating and the new coating.
- Dust and loose residues shall be removed from prepared surface by brushing, blowing off with clean dry air or vacuum cleaning prior to coating application.

6.4 System B2- Splash Zones (Steel Risers and Decks).

Coating Systems recommended for corrosion protection of splash zones are specified in Table 6-4. Options from different manufacturers are included. Any deviation shall be reviewed and approved by the Corrosion Services Manager or designated representative prior to application.

Table 6-4: Coating Systems for Splash Zones (1)

Manufacturer	**Carboline (up to 180ºF)**	**Hempel (up to 140ºF)**	**Sherwin Williams (up to 120ºF)**	**Denso (up to 150ºF)**
1st Coat				
Name/Number	Carboguard 890 GF(2)	Hempadur 45540	Duraplate 6000(3)	Rigspray
DFT	10-14 mils	10-14 mils	12-16 mils	20-40 mils
Color	Various	Black	White, Gray	Gray
2nd Coat				
Name/Number	Carboguard 890 GF	Hempadur 45540	Duraplate 6000(3)	N/A
DFT	10-14 mils	10-14 mils	12-16 mils	N/A
Color	Various	Black	White, Gray	N/A

(1) For areas exposed to UV radiation, top coat may be applied. Please consult the Corrosion Services Department for product recommendations if top coat if required.
(2) This product is available with optional filler for non-skid services (Decks).
(3) Dura-Plate 6000 can be applied in a one coat application at 24-40 mils DFT. For one coat applications, a spray stripe coat 8-12 mils can be applied to any welds and connection points on the pilings and followed immediately with the full coat of the Dura-Plate 6000 at 24-40 mils.

6.4.1 New and Recoat

Surface preparation:

- Solvent cleaning in accordance with SSPC-SP-1.
- Abrasive blasting in accordance with SSPC-SP-10, Anchor Profile: 3-4 mils.
- Dust and loose residues shall be removed from prepared surface prior to coating application.

Coating Application:

See Table 6-4 for specific manufacturer, products, and coating thickness (DFT).

Note: For field applied coating projects (assets exposed to marine environment), high pressure wash adding salt-removing chemical is recommended prior to abrasive blasting. After abrasive blasting, surface shall be tested for salt content. The substrate shall not contain chlorides in excess of 5 ppm. If soluble chlorides concentration exceeds this value, the surface will require additional chemical cleaning, followed by water rinse (fresh waterjetting). Allow the surface to dry and re-test for salt content. Once decontamination is complete, a final dry blasting will be required prior to the coating application. Apply coating as soon as possible to avoid flash rusting and salt contamination.

Note: For those coating systems requiring two coats, water rinse between coats will be required to remove salts and other contaminants from surface.

Note: Pitted steel generally is subjected to more abrasive blast cleaning repetitions or dry abrasive blast cleaning/water wash cycles to decontaminate the surface to acceptable levels.

6.4.2 Spot Repair (Touch-Up)

- Remove oil, grease and salt contaminants from surface by high pressure fresh wash cleaning adding salt removing chemical (SSPC-SP-1).
- Remove all rust and loose material by dry abrasive blasting (SSPC-SP-10), power tool cleaning (SSPC-SP-11) or waterjetting (SSPC-SP-12). For coating damages reaching the steel substrate, surface shall be cleaned to bare metal and original anchor profile shall be restored.
- The coating adjacent to the damaged coating area must be feathered and lightly sanded for a minimum distance of 1 inch to ensure adequate adhesion between the old coating and the new coating
- Dust and loose residues shall be removed from prepared surface prior to coating application.
- Apply coating to full thickness specified in Table 6-4.

6.5 Coating Systems for High Temperature Service

6.5.1 New and Recoat

Approved materials are specified in Table 6-5-1 and coating specifications for the corrosion protection of above-ground assets operating at temperatures between 200-1200ºF are included in Table 6-5-2. No substitution shall be permitted without Company approval. The selection of the coating system should be based on operating conditions, thermal cycling conditions (temperature changes), and whether or not thermal insulation is required.

Table 6-5-1: Materials for High Temperature Service

Manufacturer	Product Type	Product Name	Tint/Color
Carboline	Epoxy phenolic novolac	Thermaline 450 EP	Gray, Aluminum
	Inorganic polymer (inert-multipolymeric matrix)	Thermaline Heat Shield	Metallic Gray
Hempel	Epoxy phenolic	Hempadur 85671	Aluminum
	Inorganic polymer (inert-multipolymeric matrix)	Versiline CUI 56990	Dark Gray
Sherwin Williams	Acrylic Silicone resin	Heat-Flex Hi Temp 500	Gray, Aluminum
	Inorganic polymer (inert-multipolymeric matrix)	Heat-Flex Hi Temp 1200	Gray, Dark Gray
	Epoxy phenolic novolac	Epo-Phen FF	Gray
Dampney	Silicone Zinc dust primer	Thurmalox 245	Dark Gray
	Silicone Aluminum resin	Thurmalox 280	Aluminum
PPG Industries	Epoxy phenolic	Amerlock 2/400 GF	Dark Gray
	Acrylic Silicone resin	Hi- Temp 500 Series	Aluminum
	Inorganic polymer (inert-multipolymeric matrix)	PPG Hi-Temp 1027 HD	Gray

Note: For insulated service, ensure that the coating is completely dry/cured before the thermal insulation is installed. Please consult Manufacturer's PDS for drying/curing schedule recommendations.

Table 6-5-2: High Temperature Coating System Specification

System C1-Coating System Piping and Equipment 200°F- 500°F New and Recoat					
Surface Prep	First Coat	DFT (mils)	Second Coat	DFT (mils)	Special Instructions
SSPC-SP-10 Profile: 2-3 mils	Thermaline 450EP	4.0-8.0	Thermaline 450EP	4.0-8.0	Heat Resistance: 400°F. For insulated service only
SSPC-SP-10 Profile: 2-3 mils	Hempadur 85671	4.0-6.0	Hempadur 85671	4.0-6.0	Heat Resistance: 400°F. For insulated service only (1)
SSPC-SP-10 Profile: 2-3 mils	Amerlock 2/400 GF	4.0-6.0	Amerlock 2/400 GF	4.0-6.0	Heat Resistance: 400°F For insulated service only (1).
SSPC-SP-10 Profile: 2-3 mils	Epo-Phen FF	3.5-4.5	Epo-Phen FF	3.5-4.5	Heat Resistance: 400°F. For insulated service only(1)
SSPC-SP-10 Profile: 1.5-2.0 mils	Hi- Temp 500 Series	2.0-2.5	Hi- Temp 500 Series	2.0-2.5	Heat Resistance: 500°F. For **non-insulated** service only.
SSPC-SP-10 Profile: 2-3 mils	Heat-Flex Hi-Temp 500	2.0-2.5	Heat-Flex Hi-Temp 500	2.0-2.5	Heat Resistance: 500°F. For **non-insulated** service only.

(1) This coating may be used for non-insulated service. In this case, a top coat shall be applied for UV protection. Please consult the Corrosion Services Department for top coat recommendations.

System C2-Coating System Piping and Equipment 400°F- 1200°F New and Recoat[(2)(3)(4)]					
Surface Prep	First Coat	DFT (mils)	Second Coat	DFT (mils)	Special Instructions
SSPC-SP-10 Profile: 2.0-3.0 mils	Thermaline Heat Shield	4.0-5.0	Thermaline Heat Shield	4.0-5.0	Heat Resistance: up to 1200°F. Insulated and non-insulated service.
SSPC-10 Profile: 2.0-3.0 mils	Versiline CUI 56990	6.0-8.0	Versiline CUI 56990	6.0-8.0	Heat Resistance: up to1200°F. Insulated and non-insulated service.
SSPC-10 Profile: 1.5-2.0 mils	Thurmalox 245 primer	1.5-2.0	Thurmalox 280 Aluminum	1.5-2.0	Heat Resistance: 500-1200°F. For **non-insulated** service only.
SSPC-10 Profile: 2.0-3.0 mils	Heat-Flex Hi-Temp 1200	5.0-6.0	Heat-Flex Hi-Temp 1200	5.0-6.0	Heat Resistance: up to1200°F. Insulated and non-insulated service.
SSPC-10 Profile: 2.0-3.0 mils	PPG Hi-Temp 1027 HD	5.0-6.0	PPG Hi-Temp 1027 HD	5.0-6.0	Heat Resistance: up to1200°F. Insulated and non-insulated service.

(2) Most products will require heat curing at 350ºF for 30 minutes before equipment is placed into service. Allow at least 24-36 hours dry time prior to shipping if coating is not heat cured at the shop. Avoid mechanical abrasion during shipping and handling. Please consult Manufacturer's PDS for more detailed information about application conditions, heat curing and dry time before shipment.

(3) Some of these products can be applied direct to hot surfaces with temperature up to 500˚F (operating equipment). In this case, the coating shall be applied in multiple thin passes. Please consult Manufacturer's PDS for more detailed information about application conditions.

(4) Some products may experience color changes at high service temperature. This will not affect the coating performance.

6.5.2 Spot Repair (Touch-Up)

6.5.2.1 Repair of coating damages reaching the substrate.

Surface must be solvent cleaned according to SSPC-SP-1. The affected area should be either spot blasted (SSPC-SP-10) or Power Tool Cleaned to bare metal in accordance to SSPC-SP-11. Anchor profile shall be 1 mil minimum. All loose paint and rust shall be removed. The adjacent coating to the affected area must be feathered and lightly sanded for a minimum distance of 1 inch to ensure adhesion between old coating and new coating. Clean/wipe and remove

oil, dust, loose coating, other contaminants from the surface and apply coating according to manufacturer' recommendations. Coating DFT shall meet the requirements specified in Table 6-5-2.

6.5.2.2 **Repair of superficial coating defects.**

Surface must be solvent cleaned according to SSPC-SP-1. Lightly sand the affected area. The adjacent coating to the damage area also should be feathered and lightly sanded for a minimum distance of 1 inch to ensure adhesion between old coating and new coating. Clean/wipe and remove oil, dust, loose coating, and other contaminants from the surface. Apply coating according to manufacturer' recommendations to achieve the recommended DFT. Do not exceed the maximum DFT specified.

6.6 Complete Coating Kits

All components of the coating system shall be delivered to the job location as full containers / complete "Kits" and in the original package bearing the manufacturer's name and brand. Contractor shall protect components stored at the work site from rain, direct sunlight and temperatures above 120°F or below 32°F.

6.7 Power Mixing

Power mix separately component A and component B, then combine and power mix according to manufacturer's recommendations (consult PDS). Make sure the mixing ratio (A to B) is correct. The entire contents of a paint container shall be used in mixing to insure proper proportions of pigment and vehicle.

6.8 Thinning

Only when application procedures require thinning, the coating shall be thinned using thinners recommended by the paint manufacturer. Thinners, solvents, and paint waste shall be handled as hazardous waste. Upon request, Contractors shall provide the Company a copy of related product MSDS and Contractor's written procedures showing the proper handling of such waste. Contractor shall have this documentation at the work site at all times work is ongoing, and it shall be available to Company's representative.

6.9 Equipment and Paint Manufacturer's Recommendations

All equipment used shall conform to coating manufacturer's recommendation. Providing this specification does not address all application procedures, the paint manufacturer's recommendations shall be followed.

7 Additional Impact/Corrosion Resistant Barrier at Pipe Supports and Flanges

7.1 Pipe Supports

Upon request, additional impact resistant barrier may be applied at pipe support areas. Materials are specified in Table 7-1. In those cases where additional abrasion resistance is required due to vibration or pipe movement, Syntho-Glass or Clock Spring wrap is recommended.

- Visual inspection must be conducted around the pipe support area. Any significant pitting (metal loss) discovered shall be reported to the Area Manager (AM) for evaluation prior to abrasive blasting / coating application.
- The area around the pipe support shall be blast cleaned according to SSPC-SP-10, anchor profile 2.5-5.0 mils. SP 2888 or Protal 7200 shall be applied between 25-50 mils according to manufacturer's recommendations.
- Abrade the coating surface using sandpaper grit 80 before the adhesive and tape application. Clean the coating surface and remove any dust or abrasive residues.
- A full encirclement of Trenton Wax, Syntho-Glass or Clock Spring wrap shall be applied according to manufacturer's recommendations. Where additional mechanical protection is required, over-wrap wax tape Trenton #2 with MCO outerwrap.

Note: The Clock Spring sleeve do not require the epoxy primer application. The composite sleeve must be placed directly over the metal surface previously blast cleaned. The clock spring sleeve should be painted with the same above ground coating system for UV protection

Table 7-1: Additional Impact Resistant Barrier at Pipe-Supports

Coating Manufacturer	Product Type	Product Name / Number	Special Instructions	Tint / Color
Trenton Corp.	Trenton Wax Tape Additional Impact resistant	Trenton #2 / MCO Outerwrap	50% Overlap. Max Temp: 140°F	Brown
Innovative Composite solutions (ICS)	Syntho-Glass Tape Additional Impact/abrasion resistant	Syntho-Glass Support UV	50% Overlap. Max Temp: 250°F	Gray

Coating Manufacturer	Product Type	Product Name / Number	Special Instructions	Tint / Color
Clock Spring	Clock Spring Wrap Sleeve (3-Layer fiber glass composite)	Clock Spring Pipe Support	Max Temp: Polyester 158°F Vinyl Ester 248°F	Yellow

7.2 Flanged Connections

Upon request, an additional corrosion resistant barrier (tape) may be applied at flanged connections in order to prevent crevice and bolts corrosion. Materials are specified in Table 7-2. The flanged connections to be wrapped with tape shall be previously coated according to this specification.

- Previous to the tape application the area shall be clean and dry. Solvent clean the area to remove any oil or grease. Wire brush the surface in order to remove loose rust, loose coating, dirt or other foreign material. Surface should be wiped as dry as possible.

- Apply recommended primer or paste filling out gaps, annular space between flanges and over the entire surface to be wrapped.

- Apply the Trenton Wax #2, Densyl Tape or Stopaq Wrappingband CZH according to manufacturer's recommendations.

Table 7-2: Additional Corrosion Resistant Barrier at Flanges

Coating Manufacturer	Primer	Product Name / Number	Special Instructions	Tint / Color
Trenton Corp.	TEMCOAT 3000	Trenton #2 Wax Tape	50% Overlap. Max Temp: 140ºF	Brown
Denso	Denso Paste/Profiling Mastic	Densyl Tape	50% Overlap. Max Temp: 158ºF	Brown
SEALFORLIFE	4200 Filler	Stopaq Wrappingband CZH(1)	50% Overlap Max Temp: 158ºF	Green /Black

(1) For above ground flanges, additional Stopaq Flangebelt or Outerwrap PVC should be installed for mechanical and UV protection. Other materials are available for higher temperature requirements (up to 200°F): Stopaq Wrappingband CZHT and Outerwrap HTPE.

8 Coating System Specified for Soil-to-Air Interfaces

8.1 New and Recoat

Surface preparation and coating application for bare or coated pipe riser soil-to-air interfaces shall be performed according to the following procedures:

- **Excavation**

  Interface area shall be excavated by hand to a depth of approximately eighteen inches (18") to twenty-four inches (24") below grade.

- **Pipe Inspection**

  Any significant pitting (metal loss) discovered shall be reported to the Area Manager (AM) for evaluation prior to abrasive blasting or coating application.

8.1.1 For Bare or Coal Tar Coated Pipe

- **Surface Preparation**

  The pipe surface area at the soil-to-air interface shall be blast cleaned according to SSPC-SP-10 (near white metal) to achieve an anchor profile of 2.5 to 5.0 mils.

- **Coating Application**

  Company approved liquid epoxy coating, as specified in Table 8-1, shall be applied in a single multi-pass application (the total coating thickness specified shall be built in a continuous application process). The coating shall be applied at least eighteen inches (18") above and below grade to a total thickness of 40 to 70 mils and allowed to cure per manufacturer's recommendations. Note that the total coating DFT shall not exceed 70 mils.

  If required for added protection, at the direction of the Company, Trenton Wax #2, Polyguard RD-6 or Densyl Tape may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend approximately two feet (2') above and below grade.

Note: Before impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

8.1.2 For FBE Coated Pipe

- **Surface Preparation**

  If FBE coating is in good condition, the pipe surface area at the soil-to-air interface shall be sweep blasted according to SSPC-SP-7. If not, the existing coating shall be removed by abrasive blasting according to SSPC-SP-10. Anchor profile 2.5-5.0 mils.

- **Coating Application**

  Company approved liquid epoxy coating, as specified in Table 8-1, shall be applied in a single multi-pass application (the total coating thickness specified shall be built in a continuous application process). The coating shall be applied at least eighteen inches (18") above and below grade to a total thickness of 40 to 70 mils and allowed to cure per manufacturer's recommendations. Note that the total coating DFT, including the FBE base coat, shall not exceed 70 mils.

If required for added protection, at the direction of the Company, Trenton Wax #2, Densyl or Polyguard RD-6 tape may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend at least two feet (2') above and below grade.

> **Note:** Before impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

Table 8-1: Coating System for Soil-to-Air Interfaces

Coating Manufacturer	Product Type	Product Name - Number	DFT	Tint / Color
Special Polymer Coating (SPC)	Liquid Polymer Coating	SP-2888	40-70 mils*	None Specified
Denso	Liquid Epoxy Coating	Protal 7200	40-70 mils*	None Specified
Polyguard Coating	Polyguard Tape-Additional Interface Impact Resistant Barrier	RD-6	50% Overlap	Black – woven
Trenton Corp.	Trenton Wax Tape-Additional Interface Impact Resistant Barrier	Trenton #2 Brown	50% Overlap	Brown
Denso	Densyl Tape-Additional Interface Impact Resistant Barrier	Densyl Tape	50% Overlap	Brown

(*) Do not exceed 70 mils. For those interfaces previously coated with FBE, total DFT shall not exceed 70 mils, including FBE base coat.

8.2 Coating Repairs for Soil-to-Air Interfaces and Pipe Exposures

This procedure only applies to small coating repairs (maximum 12” in diameter coating defect) to be performed on the above-ground portion of the soil-to-air interfaces or above ground portion of exposed pipes if the coating shows any superficial defects like bubbles, disbondment or local breakdown, rust, mechanical impact without any metal loss (corrosion indicator rated as 1-2).

For all coating defects exceeding 12 inches in diameter or any surface with corrosion condition rated as 3 or 4, abrasive blasting (SSPC-SP-10) and re-coat will be required per Section 8.1.

8.2.1 For Coal Tar Coated Pipe

- **Pipe inspection**

  Inspect the affected area. If any significant pitting is found, it shall be reported to the Area Manager or a designated company representative for additional evaluation prior to surface cleaning/coating application.

- **Surface Preparation**

  If there is no evidence of corrosion with metal loss (pitting), remove any oil, dust or contaminants from surface performing solvent cleaning according to SSPC-SP-1.

  Prepare the affected area and remove old coating and corrosion products performing hand cleaning (SSPC-SP-2) or power tool cleaning (SSPC-SP-3). For small holiday repairs (less than 1" diameter coating defect), sandpaper grit 80 can be used to prepare the surface. For larger coating repairs (up to 12" diameter coating defect) where metal surface has been exposed and some corrosion products are observed, a power grinder or bristle blaster will be required to clean the surface. The coated area surrounding the repair shall also be suitably solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust, contaminants and loose coating shall be removed.

- **Coating Application**

  Apply two coats 15 mils (dry film thickness) each of Bitumastic 50 (Carboline) according to the manufacturer recommendations.

8.2.2 For FBE or Liquid Epoxy Coated Pipe

- **Pipe inspection**

If tape if present, remove old tape and inspect the affected area. If any significant pitting is found, it shall be reported to the Area Manager or a designated company representative for additional evaluation prior to surface cleaning/coating application.

- **Surface Preparation**

If there is no evidence of corrosion with metal loss (pitting), remove any oil, dust or contaminants from surface performing solvent cleaning according to SSPC-SP-1.

Prepare the affected area and remove old coating and corrosion products performing hand cleaning (SSPC-SP-2) or power tool cleaning (SSPC-SP-3). For small holiday repairs (less than 1" diameter coating defect), sandpaper grit 80 can be used to prepare the surface. For larger coating repairs (up to 12" diameter coating defect) where metal surface has been exposed and some

corrosion products are observed, a power grinder or bristle blaster will be required to clean the surface. The coated area surrounding the repair shall also be suitably solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust, contaminants and loose coating shall be removed.

- **Coating Application**

Company approved liquid epoxy coating (SP 2888 or Protal 7200), shall be applied in a single multi-pass application. Repair cartridge, brush or spray coating application are allowed. DFT: 20-50 mils.

If required for added protection, at the direction of the Company, Trenton Wax #2, Densyl or Polyguard RD-6 tape may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend at least two feet (2') above and below grade.

> **Note:** Before impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

9 Finish Coat Color Selection

Finish coat color selection shall be in accordance with Table 9-1 below.

Table 9-1: Finish Coat Color

Surface	Finish Coat Color
Structural equipment skids, pipe supports, platform decks and framing, piping, valves, pig traps, vessels, pumps, tanks	**Carboline:** Grey A 703 **Sherwin-Williams:** Grey SW 7074 Software **PPG:** Grey AM29697 **Denso:** BW Grey 801 **SPC:** SP-1088 Grey **Hempel**: Gray 17720
Fire protection equipment and apparatus, safety/emergency valves, gear/emergency shut off boxes, stop buttons/switches	**Carboline:** Safety Red 5555 **Sherwin-Williams**: Safety Red SW 4081 **PPG:** Safety Red AM79070 **Denso:** Safety Red 101 **SPC:** SP-1088 Red **Hempel:** Safety Red 57200
Top and bottoms of stair treads and handrails	**Carboline:** Safety Yellow 6666 **Sherwin-Williams**: Safety Yellow SW 4084 **PPG:** Safety Yellow AM810073 **Denso:** Safety Yellow 301 **SPC:** SP-1088 Yellow **Hempel:** Safety Yellow 27320
Walkways, stairs and supports (except top and bottom)	**Carboline:** Black C900 **Sherwin-Williams**: Black SW 4090 **PPG:** Standard Black **Denso:** Standard Black **SPC:** SP-1088 Black **Hempel:** Black 17970

Note: Other color options not included in this specification may be used based on facility local regulations. Local Area Manager shall review and approve final top colors to be applied in the facility.

10 Manufacturer's Contact Information

Table 10-1: Manufacturer's Contact Information

Name	Website	Phone Number
Carboline	www.carboline.com	(314) 644-1000
Denso	www.densona.com	(281) 821-3355
Specialty Polymer Coating	www.scp-net.com	(281) 595-3530
PPG	www.ppgpmc.com	888-977-4762
Sherwin Williams	www.sherwin-williams.com	800-474-3794
Hempel	www.north-america.hempel.com	(936) 523-6073
Dampney Company, Inc.	www.dampney.com	(616) 389-2805
Clock Spring	www.clockspring.com	(281) 590-8491
Trenton Corp	www.trentoncorp.com	(281) 556-1000
Polyguard	www.polyguardproducts.com	(580) 580-5700
Innovative Composite solutions	neptuneresearch.com	800-328-0090

11 Coating Equipment Previously Coated with Lead-Based Paint

The following requirements shall be followed when re-coating equipment previously coated with lead-based paint.

- Contractors shall provide its written Lead Abatement Procedure/ Program to the Company for review prior to starting any lead abatement project.
- It is the responsibility of Contractor to adhere to all applicable State, Local, and Federal Laws and provide any notification/documentation required by the above-mentioned agencies, prior to performing lead abatement on Company owned facilities.
- At each job site, Contractor shall have proof of its employee's lead abatement training/certification and any applicable Veriforce Operator Qualification certification for covered task relating to the coating project being performed.
- Contractor shall provide Company a representative sample of collected blasting debris from each project.
- Contractor shall place all waste streams in DOT-approved containers and label each container with date the waste was collected, and location were the waste was generated. Additional information may be requested by local Company representative.

Part II
Below-Ground Facilities

Table of Contents

Table of Tables

1 Introduction

1.1 Scope

This specification covers selection of equipment for coating, surface preparation, coating materials, and application procedures for coating underground pipe, valves, equipment, and structures.

In this coating specification any Boardwalk entity, hereafter shall be referred to as “Company” and any contract company who is contracted to apply coating shall be referred to as “Contractor.”

2 General Procedures

2.1 Purpose

This specification presents guidelines for establishing minimum surface preparation and proper application, and it identifies inspection and repair techniques to ensure long-term coating performance of liquid coatings applied to buried external pipe surfaces for coating repair, rehabilitation or field joints.

Mill / Field applied FBE coating shall be addressed using a separate Company specification.

The function of such coatings is to prevent corrosion when used in conjunction with cathodic protection.

This specification addresses coating related issues. The specification does not address any construction related procedure such as excavation, back fill, or separation of soil.

2.2 Asbestos-Based Coatings

Company Area Managers (AMs) or a Company representative should check for the presence of asbestos coatings. If asbestos coatings are present, procedures for coating equipment with asbestos coatings (see Section 8) shall be followed.

2.3 Required Documentation

Coating Contractors shall have executed the Company's applicable service agreement(s). Contractors shall also provide documentation of DOT compliance in all applicable areas.

2.4 Notification of AMs

AMs shall be notified by Company Project Managers (PMs), Company Construction Managers (CMs), or Contractor prior to starting scheduled work in their area of responsibility. Work shall be scheduled to minimize conflicts with Company operations.

2.5 Notification of Control Center

Company employee or representative shall notify the Control Center of the work schedule.

2.6 Company / Contractor Responsibilities

2.6.1

Prior to the start of work, Contractor/Inspector shall attend the orientation training. It is the responsibility of the AM or supervisor to ensure that the personnel who performs, inspects, or works in the area is properly trained in the use and operation of equipment, appropriate personal protective equipment (PPE), proper personal hygiene practices, clean up, waste disposal, emergency plan, and safety procedures.

2.6.2

Prior to the commencement of work, a pre-job meeting shall be held among the Contractor, Company, and Company's third-party inspection personnel to ensure that all parties involved fully understand the scope of work, Job Plan, safety procedures and applicable requirements.

2.6.3

Areas to be coated or painted shall be clearly identified by a Company representative. Use caution signs as needed. It is the responsibility of the job supervisor to ensure that employees working in close proximity to the job site are informed of existing hazards and appropriate measures are taken to ensure safe working conditions.

2.6.4

Contractor shall inform facility operators of all planned work activities for each day worked. All abrasive blasting activities inside the compressor stations shall be coordinated and approved by the Area Manager (AM). Abrasive blasting in the area will be allowed while the compressor units are running only if it does not interfere with the compressor operation and air intake quality is not affected.

If pipe is to be lifted from supports, pipes shall be lifted in accordance with the Company’s contract documents.

2.6.5

Contractor shall have with them at all times while on site and upon request provide to Company copies of Product Data sheets and MSDS for all materials furnished by Contractor.

2.6.6

Contractor shall complete the Company's Pre-Job and Post-Job punch list for each site.

2.7 Contractor Materials

Contractor shall furnish all labor, equipment, brushes, enclosures, coating material (approved and included in this specification), solvents, etc. necessary to complete the work.

2.8 Cleanliness

All work shall be accomplished in a neat and workmanlike manner. All phases of the cleaning and coating operation shall be subject to the approval of Company's Inspector. The work area shall be kept clean and orderly. All empty containers, rags, sandpaper, and debris shall be removed each day from the work area. Contractor shall also clear the site of abrasive blast material accumulated as a result of surface preparation and place such material in a DOT approved container.

2.9 Protection of Assets

Contractor shall be responsible for protecting all buildings, structures and equipment from over blasting, abrasive blast / dust, over spray, paint droppings, or other damage. Contractor shall be responsible for any cost associated with repair or replacement private or Company property, including, but not limited to, vehicles, facilities, or equipment, that receives damage as a result of abrasive blasting, abrasive blast dust, paint spatter, or over spray. All protective materials shall be removed at the completion of the project.

2.10 Items Not to Blast or Coat

Unless specifically noted, the following materials shall not be blasted or coated:

a) Underground pipe wrap, concrete, transformers, valve stems, drive shafts, gauges, conduit, nameplates, plastic, glass, grease fittings, stainless steel, galvanized steel or other non-ferrous small fittings or components.
b) Bare metals used for electrical grounding of assets or facilities.

c) Stainless steel, galvanized steel or other protected bolts, nuts and associated hardware.

Note: All buried or submerged stainless steel, copper, galvanized steel and other non-ferrous piping (with a total buried surface area larger than one square foot) shall be blasted and coated, except as noted above. Bare non-ferrous metallic structures can have a detrimental effect on the corrosion behavior of adjacent steel structures. See Section 3.3 for blasting instructions.

3 Surface Preparation

3.1 Surface Materials

Prior to commencing surface preparation, Contractor shall examine the surface for the presence of any deleterious materials that require removal, such as heavy corrosion of rust scale, existing elastomeric or rubber-like coatings, or previously applied tape protective systems. If any such materials that cannot be readily removed by the blast cleaning process are present, pre-blasting surface preparation must be conducted. The pre-blasting surface preparation may use any Company approved processes such as solvent cleaning, power tooling, water blasting or other removal methods.

Heavy corrosion, rust scale and pitting shall be reported to a Company representative.

3.2 Clean Surfaces

All surfaces to be abrasive blasted or painted shall be clean of any visible dirt, loose paint, oil, grease, and foreign material in accordance to SSPC-SP1. To prevent surface contamination, all containment used for asbestos abatement or coating removal shall be removed prior to application of coating.

3.3 Near White Blast Cleaning

All carbon steel surfaces shall be abrasive blast cleaned to a "Near White Blast Cleaning" in accordance with NACE 2 / SSPC-SP 10 or better. Abrasive blast shall result in a surface profile range as outlined in Table 7-1 and Table 7-2.

All stainless-steel, galvanized steel or non-ferrous surfaces, except those specifically exempted in these specifications (Section 2.10), shall be abrasive blast cleaned in accordance with SSPC-SP 16 (Brush-Off).

The size, shape and hardness of the abrasive media shall be selected based on the type of substrate (carbon steel, stainless steel or non-ferrous metals) and anchor profile requirements. Contractor shall use dry/clean abrasive and compressed air that has been passed through adequate water and oil traps. Any surface that has been blasted shall be coated the same day.

3.4 Overlap

Edges of the existing coating shall be roughened by power brushing or by sweep blasting, but not removed. The new coating shall overlap the existing coating for a minimum distance of four (4”) inches.

3.5 Contaminants (e.g., Water and Oil)

The compressed air supply used for blast cleaning shall be free of water and oil. Separators and filters shall be used on the compressed air supply to ensure that contaminates such as oil and water are not deposited on the steel surface.

3.6 Removal of Blast Products

Residual blast products shall be removed from all blasted surfaces using a clean, dry, bristle brush, vacuum, or clean, dry compressed air.

3.7 Sweep Blast

Metal areas that develop flash rust because of exposure to moisture or humidity shall be given a sweep blast to return them to their original clean blasted condition. A sweep blast shall be carried out when a blasted surface is left over night. The surface profile shall remain in accordance with Section 3.3.

4 Application

4.1 Surface Conditions

Surfaces to be coated shall be clean, dust free, dry and shall meet or exceed all surface preparation requirements in Section 3 at the time of coating application.

4.2 Weather Conditions

Contractor shall not apply coating during dusty, threatening, or rainy weather, foggy days, or when temperatures are not within coating manufacture's recommended temperatures range. Prior to and during coating application, the temperature of the substrate must be at least 5^{o}F above the dew point.

4.3 Temperatures for Pipe and Coating

Pipe and coating temperatures during application shall be in accordance with the coating manufacture's recommendations.

4.4 Cure Schedule

The curing temperature and the recoat intervals between applications and backfill shall be controlled within limits recommended by the coating manufacturer. This process must be monitored, and values recorded at least once per hour or once per site if less than one hour.

4.5 Specifications

Company approved underground coatings, and minimum / maximum thickness shall be as outlined in Table 7-1 and Table 7-2.

4.6 Pre-heating (Low Temperature Application)

In colder ambient conditions, especially in freezing or below freezing temperatures, preheating of the substrate within the specified temperature range is required to dry/cure the coating. Substrate surface temperatures outside the specified range may stop or retard the curing process. Proper preheating techniques should be performed according to manufacturer recommendations.

The following techniques are recommended for coating application during cold ambient conditions:

4.6.1

Enclose the area to be coated. The construction of tents around small areas and the use of portable heaters and/or lamps will keep the place warm and free of snowflakes.

4.6.2

If ice, snow or moisture is present on the surface, preheat the area to a temperature between 77°F and 95°F. Ensure heat is applied uniformly around the circumference of pipe, all ice/snow must be removed, and the pipe surface temperature should be 5°F above the dew point.

4.6.3

Abrasive blast the area according to Section 3.3.

4.6.4

Warm the resin and hardener using heat lamps or keeping them in warm area until you are ready to use.

4.6.5

If snowing, stir the resin and hardener in an enclosed space to avoid snow contamination. Mix the resin and hardener according to manufacturer's recommendations using a power mixer. Scrape the sides and bottom of the mixing container. Smaller diameter mixing pots will improve the chemical reaction.

4.6.6

Using an induction coil, preheat the surface according to manufacturer's recommendations. Apply coating in the temperature range specified by the coating manufacturer and according to thickness requirements as outlined in Table 7-1 and Table 7-2.

4.7 Application Methods: Brush, Roller or Spray

The coating may be applied by brush, roller or spray as follows:

Brush/Roller: coating shall be power-mixed and applied to require Dry Film Thickness (DFT) in accordance with the manufacturer's recommended practice. Please refers to Section 7.6 for power-mixing instructions.

Airless Spray System: coating shall be applied in the specified Dry Film Thickness (DFT) in a single multi-pass application using a Plural Component Airless Spray Unit. The application equipment shall be in accordance with the product manufacturer's recommendations. The system must be designed to pump, mix and atomize high viscosity, high solids coatings (100% liquid epoxies). The plural pump system shall be capable to mix and pump the product at the specified ratio.

Fully Automated Spray System (this application method only applies for field joints): coating shall be applied in the specified Dry Film Thickness (DFT) in a single multi-pass application using a fully automated, pre-programmable spray system that rotates around the pipe. This Equipment combines the plural component system and automated on-pipe spray system. All application parameters shall be programmed and continuously monitored to ensure the material is being applied at the correct mixing ratio and specified thickness.

Note: Spray is the preferred application method, since more uniform coating appearance and film thickness are achieved.

4.8 Overlap

The coating shall cover the roughened existing coating at the overlap (See Section 3.4).

4.9 Coating Condition

All coating shall be applied to uniform thickness and shall be entirely free of runs, sags, contaminates, or holidays.

4.10 Additional Coats

If additional coats are required and re-coat window has been exceeded, Contractor shall abrade existing coating to ensure inter-coat adhesion. Company inspector shall determine degree of surface preparation and additional coat(s) required to meet the coating DFT specifications.

4.11 Stripe Coats

(Brushed) stripe coats shall be applied at all areas where sharp edges are present (including pitting, welds, long seam welds, etc.) prior to final coating application.

4.12 Drying Time

Sufficient time shall be allowed for thorough drying. Drying time will depend on weather conditions and the characteristic of the coating used, but in all cases shall be within the manufacture specifications.

4.13 Curing Temperature

The curing temperature and the time interval between application and backfill shall be in accordance with the limits recommended by the coating manufacture. Coating shall not be backfilled before cure time has been established. No coating shall be covered by plastic wrap, including, but not limited to, saran wrap or foil.

5 Inspection

5.1 Inspection Equipment

Contractor shall have suitable inspection equipment at the job site to perform tests as required in this Section. This includes, but is not limited to, wet film thickness gauge, dry film thickness gauge, durometer, replica tape or equivalent, sling psychrometer or equivalent, and holiday detector.

5.2 Inspection by Company Inspector

A Company inspector shall inspect all prepared surfaces and previously coated areas and verity that the work meets coating specifications before Contractor applies the first coat or additional coats. The drying time and recoat schedule shall meet the manufacturer's published recoat schedule.

5.3 Poor Workmanship

Work shall be rejected and remediated to satisfaction of Company inspector in cases of poor workmanship. Poor workmanship includes, but is not limited to inadequate drying or curing, dirt/dust inclusions, contamination of any type, over spray, pinholes, runs, sags, holidays, lack of gloss, or low DFT.

5.4 Acceptable Finish Conditions

Acceptable finish work shall be free of abrasions, holidays, and shall be uniform in color, gloss, and appearance.

5.5 Shore D Hardness

Coating shall be allowed to cure adequately before the structure is handled or backfilled. Time intervals between application and backfield shall be controlled within limits recommended by the coating supplier. Contractor shall perform the Shore D hardness test periodically to determine if the coating is backfilling ready. Contractor shall perform durometer hardness test according to ASTM D-2240. Coating Shore D hardness measurements at 12, 3, 6 and 9 o'clock position must be taken and documented. Minimum Shore D Hardness requirements shall be as indicated in Table 7-1 and Table 7-2.

5.6 Coating Thickness

Coating Thickness shall be measured in accordance with a SSPC-PA 2 using a calibrated and company approved Pull-off Magnetic Gage Type I or Electromagnetic Gauge Type II.

5.6.1 Field Joints

Spot measurement: the average of three gage reading made within 1.5 inch diameter circle.

Area measurement: Take five randomly spot readings at 12, 3, 6 and 9 o'clock position. Report minimum, maximum and average reading found.

5.6.2 Pipeline

Spot measurement:

The average of three gage reading made within 1.5 inch diameter circle.

Area Measurement:

The average of five randomly spot measurements for each 100 square feet of coated surface.

The number of areas depend on the size of the coated surface:

- **Less than 300 square feet**, every 100 square foot area must be measured for coating thickness.
- **300 to 1,000 square feet**, three random areas are selected and measured.
- **Areas exceeding 1,000 square feet,** three random areas are selected from the first 1,000 square feet, plus one additional area for each additional 1,000 square feet.

5.7 Holiday Detection

After the coating is completely cured, the entire coated surface of each length of pipe shall be inspected with a holiday detector in accordance with NACE Standard SP0188. Coating surface shall be completely dry. Holiday inspection shall be conducted just prior to lowering the pipe into the ditch or submerging or backfilling the pipe.

The test voltage shall be adjusted to the proper voltage for the coating thickness being tested according to the procedure below:

- Measure several DFT coating thickness along the pipeline segment to determine maximum and minimum thickness.

- Make an intentional holiday through the coating until the metal substrate is exposed.

- Calibrate and ground the holiday detector prior to starting the test. The equipment should be daily calibrated.

- Start test with the lowest voltage recommended in Table 5-1 based on the coating thickness range or 100 V/mil based on the minimum measured DFT coating thickness.

- The exploring electrode shall be moved over the surface of the dry coating at rate approximately of 1 ft/s using a single pass.

- Gradually increase voltage until the holiday is detected. This will be the minimum voltage for the holiday detection test for all pipe with the same nominal coating thickness. The maximum voltage for the applied coating shall be obtained from the coating manufacturer.

- All detected holidays, including the intentionally created holiday, shall be repaired according to Section 5.8 prior to backfilling the pipe segment.

- The same procedure shall be followed when there is a change in nominal coating thickness.

Note: With this procedure, holidays will be detected without the risk of using an excessive voltage that could result in unnecessary coating damage.

Table 5-1. Minimum Suggested Voltages for Holiday Detection

Dry-Film Thickness (DFT)		Volts
Mils	Microns/mm	
8 – 11	203 – 292	1,500
12 – 15	293 – 394	2,000
16 – 20	395 – 521	2,500
21 – 40	522 – 1.03 mm	3,000
41 – 55	1.04 – 1.41 mm	4,000
56 – 80	1.42 – 2.04 mm	6,000
81 – 125	2.05 – 3.19 mm	10,000
126 – 185	3.20 – 4.70 mm	15,000

5.8 Repairs

All coating defects should be repaired using the material in Table 7-1 and Table 7-2.

- Repairs to isolated coating holiday should overlap the surrounding coating a minimum of one inch (1”).
- Remove any oil, dust or contaminants from surface performing solvent cleaning according to SSPC-SP-1.
- For small areas or holiday repairs (less than 1” diameter coating defect) sandpaper grit 80 can be used to clean the surface. For larger coating repairs (up to 12” diameter coating defect) a power grinder or bristle blaster will be required to clean the surface. All loose paint and rust shall be removed. The area surrounding the repair shall also be properly solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust shall be removed before applying coating.
- For coating repairs of areas larger than 12 inches diameter, the surface should be abrasive blast cleaned to restore surface profile according to range specified in Table 7-1 and Table 7-2. The area surrounding the repair shall also be suitably solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust shall be removed before applying the coating.
- Apply liquid epoxy according to manufacturer’s recommendations. Minimum thickness of the repair coating shall be the same thickness as outlined in Table 7-1 and Table 7-2.

Note: For coating repairs on FBE/ARO coated pipe, surface shall be sweep blasted (SSPC-SP-7) to create the anchor profile required prior to coating application.

Note: If multiple coating repairs are required in a small pipe section, they shall be grouped under a single larger repair instead performing multiple isolated coating repairs.

5.9 Backfilling

Care should be taken during backfilling in order to avoid rocks and debris impact and damage to the pipe coating. The ditch bottom should be graded and free of rock or other foreign material that could cause external coating damage or cause electrical shielding. Under difficult conditions, consideration should be given to padding the pipe or the ditch bottom or use extra mechanical protection like rock shields or pipeline felts. Pipe should be lowered carefully into the ditch to avoid external coating damage.

6 Coating Schedule: General Coating Thickness

6.1 Coating Areas

Underground piping, valves, and structural areas shall be coated with a Company approved underground coating and to the recommended thickness as outlined in Table 7-1 and Table 7-2.

6.2 Interface Areas

If the job scope of work addresses an interface area, the area shall be blasted and coated in accordance with this specification, and at the request of the Company an additional impact resistant coating shall be applied as outlined in Table 7-1 and Table 7-2.

7 Materials

7.1 Use of Coating Materials

All coating materials used shall be as listed below. Any deviation shall first be approved by the Corrosion Services Manager prior to application. ***Note: Deviation in cure time, low temperature application, high temperature application or any special application consideration shall be done in accordance with coating manufacturer's published guidelines or by a site-specific written procedures provided by the coating manufacturer's lab department.***

Table 7-1: Special Permit Pipe Requirements

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Main Line Pipe, Coating Repair, Girth Welds, Valves, Tie-ins				
Enviroline 375	140°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 2-3 mils	15-20 mils	Application Temp (substrate):70°F-120°F Minimum: 55°F Minimum Shore D Hardness before backfilling: 70. No plastic wrap
Enviroline 376F-30	140°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 3-5 mils	20-40 mils	Application Temp (substrate):70°F-120°F Minimum: 55°F Minimum Shore D Hardness before backfilling: 75. No plastic wrap
Protal 7200	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	20-50 mils	Application Temp (substrate): 50°F-212°F Surface Temp. below 50°F must be pre-heated (consult manufacturer) Minimum Shore D Hardness before backfilling: 75. No plastic wrap

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
SP 2888	176ºF	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	20-50 mils	Application Temp (substrate): 50ºF-212ºF Surface Temp below 50ºF must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Pipeclad 5000	203ºF	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 2.5-5.0	20-50 mils	Application Temp (substrate): 35ºF-150ºF Surface Temp below 35ºF must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 75. No plastic wrap
SP 8888	302ºF	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	30-50 mils	Application Temp (substrate): 50ºF-212ºF Surface Temp below 50ºF must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Damp Surface Application				
SP 4888	176ºF	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	30-50 mils	Application Temp (substrate): 40ºF-120ºF Minimum Shore D hardness before backfilling: 75. No plastic wrap
Girth Welds – Bore Application				

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Protal 7200	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	40-70 mils	Application Temp (substrate):50°F-212°F Surface Temp. below 50°F must be pre-heated (consult manufacturer) Minimum Shore D Hardness before backfilling: 80. No plastic wrap
SP 2888	176°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile;2.5-5.0 mils	40-70 mils	Application Temp (substrate):50°F-212°F Surface Temp. below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Pipeclad 5000	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	40-70 mils	Application Temp (substrate): 35°F-150°F Surface Temp below 35°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 75. No plastic wrap
SP 8888	302°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	40-70 mils	Application Temp (substrate): 50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Where Applicable - Additional Impact Resistant Coating @ Interface				
Trenton #2 Brown	140°F	Trenton Wax Tape Additional Interface Impact Resistant Coating	50% Overlap	Brown – applied over approved coating from list above

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Polyguard RD-6	145°F	Polyguard Tape -Additional Interface Impact Resistant Barrier	50% Overlap	Black Woven Back – applied over approved coating from list above
Denso	158°F	Densyl Tape	50% Overlap	Brown – applied over approved coating from list above

Table 7-2: Non-Special Permit Pipe Requirements

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Main Line Pipe, Coating Repair, Girth Welds, Valves, Tie-ins				
Enviroline 375	140°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2-3 mils	20-25 mils	Application Temp (substrate):70°F-120°F Minimum: 55°F Minimum Shore D Hardness before backfilling: 75. No plastic wrap
Enviroline 376F-30	140°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile; 3-5 mils	20-40 mils	Application Temp (substrate):70°F-120°F Minimum: 55°F Minimum Shore D Hardness before backfilling: 75. No plastic wrap
Protal 7200	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 2.5-5.0 mils	20-50 mils	Application Temp (substrate):50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D Hardness before backfilling: 80. No plastic wrap
SP 2888	176°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 2.5-5.0 mils	20-50 mils	Application Temp (substrate):50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Pipeclad 5000	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	20-50 mils	Application Temp (substrate): 35°F-150°F Surface Temp below 35°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 75. No plastic wrap

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
SP 8888	302°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	30-50 mils	Application Temp (substrate): 50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Powercrete F-1	150°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 3-4 mils	30-40 mils	Application Temp (substrate):70°F-90°F Minimum: 50°F. Maximum:176°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D Hardness before backfilling: 75. No plastic wrap
Damp Surface Application				
SP 4888	176°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	30-50 mils	Application Temp (substrate): 40°F-120°F Minimum Shore D hardness before backfilling: 75. No plastic wrap
Low Temperature Application				
SP 2831	149°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	20-30 mils	Application Temp (substrate): 32°F-50°F. Important: The application of this product is restricted to the temperature range specified for manufacturer. Under 32°F the coating will not cure. Over 50°F viscosity will be too low to reach required thickness. Minimum Shore D hardness before backfilling: 80. No plastic wrap

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Girth Welds – Bore Application				
Protal 7200	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile: 2.5-5.0 mils	40-70 mils	Application Temp (substrate):50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D Hardness before backfilling: 80. No plastic wrap
SP 2888	176°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile; 2.5-5.0 mils	40-70 mils	Application Temp (substrate):50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap
Pipeclad 5000	203°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	40-70 mils	Application Temp (substrate): 35°F-150°F Surface Temp below 35°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 75. No plastic wrap
SP 8888	302°F	NACE 2 / SSPC-SP10 "Near White Blast Clean" Profile:2.5-5.0 mils	40-70 mils	Application Temp (substrate): 50°F-212°F Surface Temp below 50°F must be pre-heated (consult manufacturer) Minimum Shore D hardness before backfilling: 80. No plastic wrap

Product Name or Number	Max. Serv. Temp.	Surface Cleanliness	Coating Thickness	Any Special Instructions
Where Applicable - Additional Impact Resistant Coating @ Interface				
Trenton #2 Brown	140°F	Trenton Wax Tape Additional Interface Impact Resistant Coating	50% Overlap	Brown – applied over approved coating from list above
Polyguard RD-6	145°F	Polyguard Tape - Additional Interface Impact Resistant Barrier	50% Overlap	Black Woven Back – applied over approved coating from list above
Denso	158°F	Densyl Tape- Additional Interface Impact Resistant Barrier	50% Overlap	Brown – applied over approved coating from list above

7.2 Soil-to-Air interface coating for Special Permit and Non-Special Permit Pipelines (New and Re-Coat)

Surface preparation and coating application for bare or coated pipe riser soil-to-air interfaces shall be performed according to the following procedures:

- Excavation

  Interface area shall be excavated by hand to a depth of approximately eighteen inches (18”) to twenty-four inches (24”) below grade.

- Pipe Inspection

  Any significant pitting (metal loss) discovered shall be reported to a Company representative for evaluation prior to abrasive blasting or coating application.

For Bare or Coal Tar Coated Pipe

- **Surface Preparation**

  The pipe surface area at the soil-to-air interface shall be blast cleaned according to SSPC-SP-10 (near white metal) to achieve an anchor profile of 2.5 to 5.0 mils.

- **Coating Application**

  Company approved liquid epoxy coating, as specified in Table 7-1 and Table 7-2, shall be applied in a single multi-pass application (the total coating thickness specified shall be built in a continuous application process). The coating shall be applied at least eighteen inches (18") above and below grade to a total thickness of 40 to 70 mils and allowed to cure per this specification. Note that the total coating DFT shall not exceed 70 mils.

  For added protection, at the direction of the Company, Trenton Wax #2 or Polyguard RD-6 may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend approximately two feet (2') above and below grade.

Note: If impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

For FBE Coated Pipe

- **Surface Preparation**

  If, in general, the existing FBE coating is in good condition, the pipe surface area at the soil-to-air interface shall be sweep blasted according to SSPC-SP-7. If, in general, the existing FBE coating is in poor condition, the existing coating shall be removed by abrasive blasting according to SSPC-SP-10 to achieve an anchor profile of 2.5-5.0 mils.

- **Coating Application**

  Company approved liquid epoxy coating, as specified in Table 7-1 and Table 7-2, shall be applied in a single multi-pass application (the total coating thickness specified shall be built in a continuous application process). The coating shall be applied at least eighteen inches (18") above and below grade to a total thickness of 40 to 70

mils and allowed to cure per this specification. Note that the total coating DFT, including the FBE base coat, shall not exceed 70 mils.

For added protection, at the direction of the Company, Trenton Wax #2, Polyguard RD-6 or Densyl Tape may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend approximately two feet (2') above and below grade.

Note: If impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

7.3 Coating Repairs for Soil-to-Air Interfaces and Pipe Exposures

This procedure only applies for small coating repairs (maximum 12" diameter coating defect) to be performed on the above-ground portion of the soil-to-air interfaces or above ground portion of exposed pipes if the coating shows any superficial defects like bubbles, disbondment or local breakdown, rust, mechanical impact without any metal loss (corrosion indicator rated as 1-2).

For all coating defects exceeding 12 inches in diameter, or any surface with corrosion condition rated as 3 or 4, abrasive blasting according to SSPC-SP-10 is required per Section 7.2.

For Coal Tar Coated Pipe

Pipe inspection

Inspect the affected area. If any significant pitting is found, it shall be reported to the Area Manager or a designated company representative for additional evaluation prior to surface cleaning/coating application.

Surface Preparation

- If there is no evidence of corrosion with metal loss (pitting), remove any oil, dust or contaminants from surface performing solvent cleaning according to SSPC-SP-1.
- Prepare the affected area by removing old coating and corrosion products, performing hand cleaning (SSPC-SP-2) or power tool cleaning (SSPC-SP-3). For small holiday repairs (less than 1" diameter coating defect), sandpaper grit 80 can be used to clean the

surface. For larger coating repairs (up to 12” diameter coating defect) were metal surface has been exposed and some corrosion products are observed, a power grinder or bristle blaster will be required to clean the surface. All loose paint and rust shall be removed. The area surrounding the repair shall also be suitably solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust, contaminants and loose coating shall be removed.

Coating Application

Apply one or two coats 15 mils each of Bitumastic 50 according to manufacturer recommendations. Let the coating dry/cure.

For FBE or Liquid Epoxy Coated Pipe

Pipe inspection

If tape is present, remove old tape and inspect the affected area. If any significant pitting is found, it shall be reported to the Area Manager or a designated company representative for additional evaluation prior to surface cleaning/coating application.

Surface Preparation

- If there is no evidence of corrosion with metal loss (pitting), remove any oil, dust or contaminants from surface performing solvent cleaning according to SSPC-SP-1.
- Prepare the affected area by removing old coating and corrosion products, performing hand cleaning (SSPC-SP-2) or power tool cleaning (SSPC-SP-3). For small holiday repairs (less than 1” diameter coating defect), sandpaper grit 80 can be used to clean the surface. For larger coating repairs (up to 12” diameter coating defect) were metal surface has been exposed and some corrosion products are observed, a power grinder or bristle blaster will be required to clean the surface. All loose paint and rust shall be removed. The area surrounding the repair shall also be suitably solvent cleaned, roughened and feathered for a minimum distance of 1 inch. All dust, contaminants and loose coating shall be removed.

Coating Application

Company approved liquid epoxy coating, as specified in Table 7-1 and Table 7-2, shall be applied in a single multi-pass application. Repair cartridge, brush or spray coating application are allowed. DFT: 20-50 mils. Let the coating dry/cure according to manufacturer’ curing table.

If required for added protection, at the direction of the Company, Trenton Wax #2, Densyl or Polyguard RD-6 tape may be applied starting at the bottom of the pipe riser, over the Company approved underground coating, and wrapped upwards using a fifty (50%) percent wrap overlap. The wrap shall extend at least two feet (2') above and below grade.

> **Note:** Before impact protection tape is applied, ensure that sufficient curing time for the liquid epoxy is allowed per manufacturer's curing schedule.

To protect from UV damage, the above grade portion of the interface shall be coated with the same top or finish coating as the above ground structure.

7.4 Additional Corrosion Protection at Buried Flanged Connections

The application of an additional corrosion resistant barrier (tape/wrap) on buried flanged connections is recommended to prevent crevice corrosion of the flange and galvanic corrosion of bolt and nuts. The following procedure shall be followed to coat below ground flanged connections:

- Prepare and coat the external surface of the flange in accordance with Section 7.1 of this specification. Approved coatings are specified in Table 7-1 and Table 7-2. Bolts and nuts shall not be coated with liquid epoxy. Bolts and nuts shall be covered during the liquid epoxy coating application.
- Previous to tape application, the liquid epoxy coating shall be completely cured and the surface shall be clean and dry. Solvent clean the flange surface to remove oil or grease. Wire brush the surface in order to remove loose rust, loose coating, dirt or other foreign material. Surface should be wiped as dry as possible.
- Apply recommended primer or paste over the entire flange surface, filling gaps and the annular space between flanges. Existing carbon steel bolts and nuts shall also be coated with primer if they cannot be removed during the coating application. Teflon-coated or cadmium bolts and nuts are recommended for new installations or when existing bolts and nuts can be replaced.
- Apply Trenton Wax #2, Densyl Tape or Stopaq Wrappingband CZH according to manufacturer's recommendations. See Table 7-3 for additional tape coating information.

Table 7-3: Additional Corrosion Resistant Barrier at Buried Flanges

Coating Manufacturer	Primer	Product Name / Number	DFT	Special Instructions
Trenton Corp.	TEMCOAT 3000	Trenton #2 Wax Tape (Max. Temp 145 °F)	50% Overlap	Brown – applied over approved coating from table 7-1 & 7-2
Denso	Denso Paste/Profiling Mastic	Densyl Tape (Max. Temp 158 °F)	50% Overlap	Brown – applied over approved coating from table 7-1 & 7-2
SEALFORLIFE	4200 Filler	Stopaq Wrappingband CZH/Outerwrap PVC(1) (Max. Temp 158 °F)	50% Overlap	Green/black – applied over approved coating from table 7-1 & 7-2

(1) Other materials are available for higher temperature requirements (up to 200°F): Stopaq Wrappingband CZHT and Outerwrap HTPE.

7.5 Complete Coating Kits

All components of the coating system shall be delivered to the job location as full containers / complete “Kits” and in the original package bearing the manufacturer's name and brand. Contractor shall protect components stored at the work site from rain, direct sunlight, and temperatures above 120°F or below 32°F.

7.6 Power Mixing

If coating application requires pre-mixing the components prior to application, both part “B” and/or part “A” shall be power-mixed separately according to manufacturer’s recommendations using the original or clean containers. Then, the two parts (hardener and base) shall be combined and power-mix according to manufacturer’s recommendations. The entire contents of a paint container shall be used in mixing to ensure proper proportions of pigment and vehicle. Only mix base and hardener identified by same kit size. Mix at low speed to avoid vortex that could introduce air into the product making sure the bottom and sides of container are scraped. The mix shall have a uniform color, no streaks present.

7.7 Thinning

Only when application procedures require thinning, the coating shall be thinned using thinners recommended by the paint manufacturer. Thinners, solvents, and paint waste shall be handled as hazardous waste. Upon request, Contractor shall provide Company a copy of related product MSDS and Contractors' written procedures showing the proper handling of such waste. Contractor shall have this documentation at the work site at all times work is ongoing, and it shall be available to the Company's representative.

7.8 Equipment and Paint Manufacturer's Recommendations

All equipment used shall conform to coating manufacturer's recommendation. Providing this specification does not address all application procedures, the paint manufacturer's recommendations shall be followed.

8 Coating Equipment Previously Coated with Asbestos Coating

The following requirements shall be followed when coating equipment previously coated with asbestos coating:

- Contractor shall provide its written Asbestos Abatement Procedure/ Program to Company for review prior to starting any asbestos abatement project.
- It is the responsibility of Contractor to adhere to all applicable State, Local, and Federal laws and provide any notification/documentation required by the above mentioned agencies, prior to performing asbestos abatement on Company owned facilities.
- At each job site, Contractor shall have proof of its employee's asbestos abatement training/certification and any applicable VERIFORCE OQ certification for covered task relating to the coating project being performed.
- Contractor shall provide Company a representative sample of collected blasting debris from each project.
- Contractor shall place all waste streams in DOT-approved containers and label each container with date the waste was collected, and location were the waste was generated. Additional information may be requested by local Company employees.
- Contractor shall comply with the asbestos requirement set for in the contract documents.

Table 8-1: Manufacturer's Contact Information

Name	Website	Phone Number
Enviroline	www.envirolinegroup.com	(954) 978-9355
Denso	www.densona.com	(282) 821-3355
Special Polymer Coatings (SPC)	www.spc-net.com	(713) 248-3951
Polyguard	www.polyguardproducts.com	(713) 681-1743
Trenton Corp	www.trentoncorp.com	(337) 828-0177
SEALFORLIFE	www.sealforlife.com	(281) 360-0785

9 Document Control

As part of the Company's Management of Change procedure, this section provides information about updates to this document.

Revisions to this document are recorded in the following table. Minor revisions (new formatting, title changes, minor updates, etc.) are indicated by a fractional increase. Major revisions (new critical information, significant re-arrangement of information, etc.) are indicated by a whole number increase. See the indicated Change Request(s) for full details on changes made to a document.

Table 9-1: Document History Log

Version	Effective Date	Description
3.00	09/09/2021	New document created by the combination of General Coating Specifications: Above-Ground, Below-Ground, High Temp Above-Ground and Offshore per CR 2021-06-30
3.10	03/11/2022	Edits to coating product names and specifications in Part I Above-Ground Facilities per CR 2022-02-14; additional minor edits throughout and changes to Dry Film Thickness reading information per CR 2022-03-04
3.20	05/31/2024	Instituted task list numbering per CR 2024-05-01a

Report any incorrect information or broken links in this document to Compliance Services.