

# Protective Coatings – Below Ground Steel Surfaces – Field Applied

## STD.7002

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### Scope

This specification shall apply to the selection of material, surface preparation, coating application and coating repair to be used on all Company below ground new construction and existing pipelines and facilities, including stainless steel and non-ferrous materials. The information contained in this specification is for the use of authorized Company personnel. The information contained in this specification is considered proprietary to Company and the specifications, approved coating list, and application procedures will not be distributed to non-company personnel without the approval of the Corrosion Prevention Manager or Supervisor.

Application of this specification must be carried out by persons qualified by experience, training, and certification in buried/submerged pipeline protective coating corrosion control methods.

The Corrosion Prevention Manager/Supervisor shall review exceptions or deviations from this specification, including procedures provided by manufacturers, for approval.

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## 1.0 REFERENCES

### 1.1. American Petroleum Institute (API)

API 1104	Welding of Pipelines and Related Facilities, 20th Edition
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### 1.2. National Association of Corrosion Engineers (NACE)

RP0105	Liquid-Epoxy Coatings for External Repair, Rehabilitation, and Weld Joints on Buried Steel Pipelines
SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
SP0274	High-Voltage Electrical Inspection of Pipeline Coatings
SP0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
SP0490	Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760 $\mu\text{m}$ (10 to 30 mil)

### 1.3. Society of Protective Coating (SSPC) and NACE Cleaning Standards

PA 1	Shop, Field, and Maintenance Painting of Steel
SP 1	Surface Preparation Standard No. 1: Solvent Cleaning
SP 2	Surface Preparation Specification No. 2: Hand Tool Cleaning
SP 3	Power Tool Cleaning
SP 5/NACE No. 1	Joint Surface Preparation Standard: White Metal Blast Cleaning
SP 6/NACE No. 3	Joint Surface Preparation Standard: Commercial Blast Cleaning
SP 7/NACE No. 4	Joint Surface Preparation Standard: Brush-Off Blast Cleaning
SP 10/NACE No. 2	Joint Surface Preparation Standard: Near-White Metal Blast Cleaning
SP 11	Power Tool Cleaning to Bare Metal
SSPC PA 2	Procedure for Determining Conformance to Dry Coating Thickness Requirements
SP 16	Brush-Off- Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
Steel Structures Painting Manual, Volume 1	Good Painting Practice
Vis 3	Guide and Reference Photographs for Steel Surfaces Prepared by Power- and Hand-Tool Cleaning
Vis 1	Guide for Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

#### 1.4. U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA)

49 CFR Part 192	Transportation of Natural and Other Gas by Pipeline; Minimum Federal Safety Standards
49 CFR Part 195	Transportation of Hazardous Liquids by Pipeline

#### 1.5. Company Standards and Specifications

Form 140	Maintenance Report
STD.7003	Protective Coatings – Below Ground Steel Surfaces – Plant Applied Fusion-Bonded Epoxy and Abrasion-Resistant Overlay
STD.7004 – Below Ground	Coating Inspection Report – Below Ground

## 2.0 DEFINITIONS

**ARO** – Abrasion Resistant Overlay coating used to protect FBE mainline coatings for directional drilling, bores, river crossings and other rough terrain applications.

**CFM** – Cubic feet (per) minute. A measure of the flow rate of air pushed out by a compressor.

**Cathodic Protection (CP)** – A technique to reduce the corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

**Company** – Enterprise (if used in connection with a contract or other agreement, the actual Enterprise entity will be the specific Enterprise entity referenced in the contract).

**Company Project Manager** - An employee or contingent worker of Enterprise who has the overall responsibility for the project. For example, this can be someone in Capital Projects, Field Engineering, Maintenance or Operations.

**Coating** – A liquid, liquefiable, or mastic composition that, after application to a surface, is converted into a solid protective, decorative, or functional adherent film.

**Contract Drawings** – The drawings approved by Company Project Manager and incorporated by reference in the Contract.

**Contract** – The document issued by Company Project Manager to Contractor formally defining the terms and conditions, quantities, technical/quality standards, and delivery schedule to be provided in accordance with this specification.

**Contractor** – Company contracted to perform the surface preparation and protective coating services referenced herein.

**Corrosion** – The deterioration of a material, usually a metal, that results from a chemical or electrochemical reaction with its environment.

**Designated Representative** – Individual identified in the Contract as the contact to whom Contractor shall direct all communications, correspondences, and notifications for Company.

**DFT** – Dry film thickness.

**FBE** – Fusion Bonded Epoxy coating.

**Holiday** – A discontinuity in a protective coating that exposes unprotected surface to the environment.

**NACE** – National Association of Corrosion Engineers.

**MSDS** – Material Safety Data Sheet.

**RCRA** – Resource Conservation and Recovery Act.

**SSPC** – Steel Structures Painting Council.

## 3.0 SPECIFICATION

### 3.1. General

- (1) Under this specification the Coating Applicator shall be referred to as Contractor, and Company's authorized representative(s) shall be referred to as qualified Inspector(s). The Company qualified Inspector will be experienced and knowledgeable in the application of coatings. NACE or SSPC certification is preferred.
- (2) This specification is not all-inclusive. It is the responsibility of Contractor to be knowledgeable in all areas of coatings and their application. Contractor represents and warrants familiarity with the work to be performed pursuant to these specifications, and has the responsibility of compliance with all the applicable regulations, codes, standards, and specifications, including those related to occupational safety and environmental protection. All excavation and backfill operations shall be performed in accordance with Company specifications.
- (3) Contractor shall be trained and/or certified by manufacturer of product(s) and/or equipment. Contractor shall have certification available upon request.
- (4) Except for new construction and non-DOT regulated activities, the Contractor shall be qualified to perform work in accordance with the Department of Transportation (DOT) Operator Qualification Rule.
- (5) Contractor shall have copies of printed data sheets and Safety Data Sheets (SDS) available at the site where coating work is being performed.
- (6) Qualified Inspector(s) shall have access to the work at all times, with the right to inspect and approve the work and materials furnished by Contractor. All such work shall be subject to approval of qualified Inspector(s). Failure to discover or reject defective work or materials shall not be construed as acceptance of such work.
- (7) Contractor shall be responsible for all quality control checking, including visual inspection, thickness measurements, and holiday testing. Contractor shall notify qualified Inspector(s) when these tests are to be performed to allow for verification. A copy of all records of the results of such inspections shall be made available to qualified Inspector(s) on a daily basis.
- (8) For liquid epoxies, Contractor shall measure Dry Film Thickness (DFT) with a Company-approved gauge. Determination of DFT shall be based on a sufficient number of spot measurements needed to verify compliance with the requirements listed in the manufactures' product data sheet and/or this specification. As a general guideline, one spot measurement per 10 linear feet is recommended to assure compliance. A spot measurement is defined as the average of three gauge readings taken in close proximity. The gauge readings must be no closer than 0.5 in. and no further apart than 3 in. Each gauge reading shall be at least 100 percent of the specified minimum thickness and less than 120 percent of the specified maximum. The average of the three gauge readings constitutes a spot measurement. The spot measurement must fall within the specified DFT range as listed in the manufactures' product data sheet and/or this specification.
- (9) All materials shall be applied by qualified personnel and according to this specification. If not stated in this specification, the manufacturer's recommended procedures shall be followed after approval by a Corrosion Prevention Group member.
- (10) All peripheral facilities shall be properly protected against abrasive blasting operations, overspray, dropping, and spattering of coatings.
- (11) Storage of coating materials in the field shall be in accordance with the manufacturer's recommended procedures.

- (12) Contractor shall provide protective cover for storage site during adverse weather such as rain or snow. Qualified Inspector(s) shall approve protective methods.
- (13) Contractor/Applicator must be aware that all approved coating materials have environmental application tolerances that must be considered when selecting a coating and planning a project. Since application difficulty and extended cure times can be encountered at or near the material's temperature application ranges, always consult with the manufactures' representative and/or the applicable product data sheet for proper project planning. In general, adverse weather conditions such as rain, snow, high winds, dust storms, low temperatures, and high humidity (90 percent maximum) should be anticipated far enough in advance to avoid application and drying or curing under these conditions.
- (14) Contractor shall be responsible for protective safety equipment and personal safety of workers.
- (15) Protective padding shall be used during welding operations to prevent the burning and damaging of the protective coatings on pipe and fittings.
- (16) All welds to be coated shall present a neat and workmanlike appearance in accordance with the visual examination requirements in API 1104. Coating shall not be applied until all required weld NDE is complete.

### 3.2. Surface Preparation Requirements

Requirements for surface preparation as specified by the coating systems are based on SSPC SP 1, SP 2, SP 3, SP 5, SP 6, SP 7, SP 10, SP 11, and SP 16 as appropriate.

### 3.3. Coating Application Requirements

Requirements for coating application are based on SSPC PA 1 and PA 2 and coating supplier's requirements.

### 3.4. Soil-to-Air Interface (Transition Coating)

- (1) The soil-to-air interface is the area above and below the natural ground level where pipeline corrosion is most likely to occur. It is an area greatly affected by moisture levels, certain bacteria, temperatures, oxygen levels and pH levels. An increase in corrosion can also occur if this area is exposed to agricultural fertilizers, animal excrement and any chemicals with excessive pH levels.
- (2) The soil-to-air interface shall only be coated with epoxy (coal tar epoxy shall not be used). No cold-applied tapes, hot wax, or shrink sleeves shall be used for soil-to-air interface areas.

### 3.5. Stainless Steel and other Metallic Materials

- (1) All buried Company carbon steel assets are protected from corrosion by a combination of coatings and cathodic protection. Buried or submerged stainless steel, copper, galvanized, and other non-ferrous metals that are not coated can have a detrimental effect on the facility cathodic protection systems. Therefore, unless excluded in Section 3.5(3) below, all buried stainless steel, copper, galvanized or other non-ferrous metals shall be coated.
- (2) For Reference, the detrimental effects of buried, bare non-ferrous metals may include but are not limited to:
  - (a) Current Drainage – Bare metallic structures extract large amounts of Cathodic Protection (CP) current from site CP systems that often makes it difficult to achieve adequate site CP levels.
  - (b) Improper Current Distribution – Large, bare metallic structures that act as current drains interfere with Company's ability to uniformly distribute cathodic protection current to other buried assets.
  - (c) CP Survey Issues – Mixed metal potentials created by large buried non-carbon steel assets can limit Company's ability to obtain accurate CP survey potential measurements.



- (3) The following exclusions do not require coating:
- (a) Bare metals that are utilized for the proper grounding of a site, asset or facility. Mainly bare copper or copper clad grounding rods and wire.
  - (b) Small - less than two (2) square feet of total surface area, bare non-ferrous piping of facility components.
  - (c) Stainless, galvanized or otherwise protected bolts, nuts and associated hardware

### 3.6. Coating Types

- (1) Based on performance histories of various coatings, the Corrosion Prevention Group recommends the following order of preference in the selection of coating types. Only approved coating types for the particular project type may be considered.
- (a) Fusion-Bonded Epoxy
  - (b) Liquid Epoxy Coatings
  - (c) Fusion-Bonded Epoxy Repair Systems
  - (d) Cold-Applied Tape
  - (e) Coal Tar Mastic
  - (f) Coal Tar Enamel
- (2) **Fusion Bonded Epoxy** – Epoxy based powder coating that is widely used to protect steel pipe from corrosion. With applied heat, the powder resin and hardener components melt and flow onto the metal and soon become a solid coating by a chemical process called cross-linking. This process is known as “fusion bonding.”
- (3) **Liquid Epoxy Coatings** – Two-part, ambient temperature cured, resin coating system with high mechanical properties, temperature and chemical resistance. Apply only to dry surfaces unless specified in the approved materials description.
- (4) **Fusion-Bonded Epoxy Repair Systems** – Epoxy based coating repair system specifically used to patch coating. For FBE repairs only.
- (5) **Cold-Applied Tape** – Polymer based adhesive tapes, which usually consist of a primer with single or multiple layers of a polymeric tape. Cold-applied tape shall only be used in limited special applications such as minor coating repair projects.
- (6) **Coal Tar Mastic** – Bituminous based coating filled with clays, silica, and fiberglass that is cold applied. Coal tar mastic shall only to be used in limited special applications such as test lead and / or cable attachment projects.
- (7) **Coal Tar Enamel** – A polymer based coating produced from the plasticization of coal tar pitch, coal, and distillates, usually hot applied. Coal tar enamel shall be used only in special situations where a repair is made to existing coal tar enamel or weld joint tie-ins are coated and overlapped with coal tar enamel on one or both sides of the tie-in. Coal tar enamel may be used during extreme cold weather conditions for general joint tie-ins and repairs only when backfill time is critical.

### 3.7. Project Types

- (1) All coating projects shall be classified into one of four project types per the definitions below. The four project types are:
- Field Joints (New Construction)
  - Recoat (Existing Coating Removal)
  - Minor Coating Repairs (Patching)
  - Test Lead and/or Cable Attachment



- (2) **Field Joints (New Construction)** – Applies to field joint coating application on new construction projects only.
- (3) **Recoat (Existing Coating Removal)** – Applies to coating application after existing coating is removed such as Operations recoat projects, Pipeline Integrity rehabilitation projects, and Corrosion Prevention recoat projects.
- (4) **Minor Coating Repairs (Patching)** – Applies to minor coating patching on an existing coating holiday. This project type is not intended for any planned recoat projects as described in section 3.6 (3) above.
- (5) **Test Lead and/or Cable Attachment** – Applies to coating application on the installation area of cathodic protection devices such as test leads and bond cables.

### 3.8. Exceptions and / or Deviations from this Standard

Any exceptions or deviations from the approved materials, coating systems, and/or standard must be pre-approved by the local area Corrosion Prevention Manager or Supervisor.

## 4.0 FIELD JOINTS AND NEW CONSTRUCTION

### 4.1. Field Joints - General

- (1) Allowable field applied coating types for field joints and New Construction projects are fusion bonded epoxy and liquid epoxy coatings.
- (2) Coating types not allowed for field joints and New Construction are fusion-bonded epoxy repair systems, cold applied tape, coal tar mastic, and coal tar enamel.
- (3) Abrasive blast materials shall not be recycled unless automatic reclaiming equipment is used.
- (4) Bare cutback and areas to be coated shall be protected from seawater and any other contamination.
- (5) Flocking of Fusion Bonded Epoxy (FBE) is not permitted.
- (6) No reclamation of FBE is allowed unless automatic reclamation or recycling equipment is employed.
- (7) Overcoating cured FBE with FBE is not permitted.
- (8) If existing FBE coating does not meet specified FBE coating thickness, overcoating with liquid coating to make up the difference is not allowed.
- (9) FBE powder more than six months old shall not be used unless it has been stored in accordance with the powder coating manufacturer's recommendations.

### 4.2. Field Joints - Surface Preparation

- (1) The weld zone and surfaces to be coated shall be inspected and pre-cleaned according to SSPC-SP1 to remove mud, oil, grease, moisture, and loosely adhering deposits. Visible oil and grease spots shall be removed by solvent wiping. Only safe, residue-free environmentally approved solvents shall be used.
- (2) The adjacent mill-applied coating shall be roughened by brush blasting the coating surface for a distance of approximately 2 to 2-1/2 inches prior to coating application. Blast nozzle must be directed from the coated surface to the adjacent substrate rather than from the substrate onto the coating.
- (3) The abrasive-blast cleaned surface shall be protected from conditions of high humidity, rainfall, and surface moisture. The abrasive blast-cleaned surface shall not be allowed to flash rust prior to coating application.

### 4.3. Field Joints – Coating Application

#### 4.3.1. FBE over FBE

The weld zone shall be heated in accordance with manufacturer's recommendations, but not to exceed 475°F, using an induction-heating coil of sufficient size, width, and power to provide the required heat in the weld zone and 2 inches of the fusion-bonded pipe coating. The heat shall be gradually applied at a rate to prevent blistering, disbondment, or other anomalies to the existing plant-applied pipe coating. Graduated Tempilstik or other applied methods shall be used to measure the temperature; only the smallest spot of metal is to be touched with the Tempilstik.

##### 4.3.1.1. Single-Layer Fusion-Bonded Epoxy Powder

After the induction coil is removed, install the powder-application apparatus around the field joint. Apply the approved dry-film thickness FBE powdered coating as rapidly as possible to prevent premature cool-down of the heated zone, to achieve the minimum dry-film thickness.

##### 4.3.1.2. Two-Layer FBE and Abrasion Resistant Overlay (ARO)

After the induction coil is removed, install the specifically designed powder-application apparatus around the field joint. Apply the approved dry-film thickness FBE powdered coating as rapidly as possible to prevent premature cool-down of the heated zone, followed immediately by the approved dry-film thickness ARO powdered coating.

#### 4.3.2. Liquid Epoxy over FBE

##### 4.3.2.1. Airless Spray Application

- (i) Airless tips shall be of proper size and fan angle, as recommended by the manufacturer of the coating being applied and of the equipment being used.
- (ii) Airless spray equipment shall be equipped with an electric ground wire in the high-pressure line between the gun and the pumping equipment. The pumping equipment shall be properly grounded to avoid build-up of static charge on the gun.

##### 4.3.2.2. Plural Component Spray Application

Plural component spray equipment shall be equipped with an electric ground wire in the high-pressure line between the gun and the pumping equipment. The pumping equipment shall be properly grounded to avoid build-up of static charge on the gun. Recommend flushing hoses within 3 – 4 minutes of completion of application.

##### 4.3.2.3. Brush and Roller application

Brushes and rollers shall be of style, size, and quality to enable proper application of coating according to manufacturer's recommendation. The coating shall be applied with the conformity and thickness specified.

#### 4.3.3. Liquids over mill applied ARO liquids (SPC 2888 and Powercrete J products only)

- (1) ARO is to be used only when specified and approved by Company Project Manager.
- (2) Over-coating semi or cured liquid ARO that does not meet the minimum specified thickness, or due to any other anomalies, is not permitted unless approved by the Corrosion Prevention Manager or Supervisor.
- (3) Surface preparation shall be performed in accordance with Section 4.2 of this standard.
- (4) Contractor shall mix the coating thoroughly in accordance with manufacturer's recommendation.
- (5) Preheating of the surface to be coated shall not exceed temperatures as specified in the Manufacturer's product data sheet.

- (6) Contractor shall apply liquid coatings by brushing, rolling, or spray application in accordance with manufacturer's recommendation to achieve the similar coating thickness as the original pipe coating thickness.

#### 4.4. Field Joints – Coating Inspection and Cure Time

- (1) Coating shall be allowed to cure per manufacturer recommendation before the structure is handled or backfilled. Not following the manufacture recommendations may cause severe immediate degradation of the newly applied coating.
- (2) Time interval between application and backfill shall be controlled within the limits recommended by the coating supplier. The nondestructive test method that shall be periodically conducted to determine if the coating is backfill ready is the Shore D Hardness Test as referenced in NACE RP0105 Liquid-Epoxy Coatings for External Repair, Rehabilitation, and Weld Joints on Buried Steel Pipelines Section 8.2.5.4.2. Minimum Shore D hardness requirements shall be as indicated in Tables 9.2 and 9.3 of this standard.
- (3) Inspection results must be documented on Company STD.7004 (Below Ground) Coating Inspection Report or other approved document.
- (4) Should any of the following conditions not be met, the Contractor shall recoat the coated field joints:
- (a) The maximum allowable holiday density on any field joint of up to and including 20 in. diameter shall be three holidays, and of larger than 20 in. diameter, six holidays.
  - (b) Coating field joints with continuous or semi-continuous holidays.
  - (c) Any one holiday exceeding five inches.
  - (d) Cured coating shall be of uniform color, gloss, and thickness and shall be free of blisters, pinholes, craters, fish eyes, sags, bubbles, runs, drips, foreign matter and other irregularities or anomalies.

#### 4.5. Field Joints - Holiday Detection

- (1) Holiday inspection for FBE coatings up to 30 mils Dry Film Thickness (DFT) shall be in accordance with NACE SP0490. This excludes dual layer FBE coating systems and FBE with ARO.
- (2) Holiday inspection for all other buried or submerged pipeline coatings shall be in accordance with the Manufacturer's recommendations as listed in Table 9.3 of this standard.
- (3) One-hundred percent of the coated surface shall be holiday inspected. Holiday inspection shall be conducted just prior to lowering the pipe into the ditch or submerging or backfilling the pipe. Any coating damage discovered must be repaired. Inspection results must be documented on Company STD.7004 (Below Ground) Coating Inspection Report or other approved document.
- (4) The detector shall be equipped with a visual and/or audible alarm to signal current flow through the apparatus.
- (a) To verify test voltages for FBE coatings up to 30 mils, reference the procedure outlined in Section 3.3 of NACE SP0490.
  - (b) To verify test voltages for all other buried or submerged pipeline coatings, reference the Manufacturer's recommendation and Table 9.3 of this standard.
- (5) Holiday detection voltage settings are established based upon the average of the specified coating dry film thickness range as stated in Table 5.1 of Company STD.7003 Protective Coatings – Below Ground Steel Surfaces or the Manufacturer's recommendation as stated in tables included in Section 9.0 of this Standard.
- (a) For FBE coating up to 30 mils, the minimum holiday detection voltage is determined based upon the equation included in Section 3.5, Equation 1, of NACE SP0490.

Example:

Specified DFT range = 15 – 22 mils

Average of specified DFT range = 18.5 mils

Testing Voltage (V) =  $K \sqrt{T} = 525 \sqrt{18.5} = 2,250$  volts (rounded to the nearest 50 volts)

**Note:** In accordance with section 3.5 of NACE SP0490, "The minimum testing voltage for a particular coating system shall be within 10% of the value determined by the Equation."

#### 4.6. Field Joints - Fills, Offshore/Onshore

- (1) Field joint fill is not required for road bores unless specified by Company Project Manager.
- (2) Polyurethane foam field joint fill shall be a two-component (two-part) material that rises and expands completely over the girth weld anti-corrosion coatings and fills the joint annulus on concrete-coated pipe. When measured parallel to the foam rise, the polyurethane foam shall have a minimum core compressive strength of 1500 psi at 90 percent deflection and a minimum compressive strength of 350 psi at 60 percent deflection. It shall have a core density of 12 pounds per square inch or a density sufficient to support the weight of the pipe as it travels over the barge rollers. The urethane shall also have an open cell content of at least 80 percent.
- (3) After the field joint has been coated and approved by qualified Inspector(s), manufacturer's recommended mold shall be positioned over the field joint area and extended over the plant-applied concrete coating by approximately 6 inches, leaving an injection port on the top of the form. The mold shall be securely strapped and banded in place.
- (4) Qualified Inspector(s) shall determine that there is no structural effect on the overall joint.
- (5) The form shall be filled with polyurethane foam material at a sufficient injection capacity rate to keep up with the pipe lay operation. Injection rate and timing shall be according to manufacturer's recommendations so that the required material properties are achieved.
- (6) A complete pipe joint may be de-molded after 1 minute of curing.
- (7) Field joints shall be visually inspected to locate any voids. Voids of greater than 3 inch diameter but less than or equal to 12 inch diameter shall be manually repaired. Joints with voids greater than a 12 inch diameter shall be rejected. The rejected fill shall be removed and replaced by Contractor at no cost to Company. Post-curing cracks need not be filled if the qualified Inspector(s) determine there is no structural effect on the overall joint.
- (8) For manual repairs, polyurethane foam material components "A" and "B" shall be mixed in metering cups to obtain the density required by this specification. Sufficient material shall be poured into the void so that it is completely filled upon rising. Excess material shall be trimmed for a finish flush with the surface of the joint.
- (9) If Contractor fails to promptly correct causes of regularly recurring voids or other defects, the field joint may be rejected and Company qualified Inspector shall have the right to stop all work until the cause is remedied.

### 5.0 RECOAT (EXISTING COATING REMOVAL)

#### 5.1. Recoat - General

- (1) Allowable coating types for Recoat (Existing Coating Removal) are liquid epoxy coatings including Specialty Polymer Coatings (SPC), Powercrete J, Scotchkote 323, and Protol products.
- (2) From the list of coating types, coating types not allowed for Recoat (Existing Coating Removal) are fusion-bonded epoxy, fusion-bonded epoxy repair systems, cold applied tape, coal tar mastic, and coal tar enamel.

- (3) For coatings that are well bonded and generally in good condition, as determined by the Company qualified Inspector, remove as little as required to perform the project work. No additional coating removal is required. For coatings that are in poor condition, consideration should be given to the removal of all exposed coating and prepare for recoat.
- (4) The Contractor shall remove coating in a manner that does not cause an unsafe condition or damage the pipe. Any method of coating removal that may scar, dent, or damage the pipe surface is strictly prohibited.
- (5) Contractor shall comply with all jurisdictional environmental rules and regulations regarding the removal, handling, and disposal of any coating.

## 5.2. Recoat - Surface Preparation

- (1) Prepare the surface as required for the applicable coating system. If the surface is not prepared per the required procedures, coating will not adhere and cause severe immediate degradation of the newly applied coating.
- (2) Abrasive blast cleaned surfaces should not be permitted to stand overnight without being primed or coated.
- (3) Only Company-approved abrasive material that meets all provisions of federal, state, and local regulations shall be used. The abrasive shall contain no impurities and shall be used in accordance with the manufacturer's recommended procedures. Abrasives shall be either sharp steel grit, a mixture of steel grit and steel shot, coal slag, garnet, or aluminum oxide and meet the following requirements:
  - Contain less than 1 percent free silica.
  - Be free of harmful quantities of toxic metals.
  - Contain less than 125 ppm water soluble chlorides.
  - Contain less than 200 ppm water soluble sulfates.
  - Be free of clay, limestone, shells, undersized or oversized particles, organic materials, and other detrimental foreign materials.
- (4) Contractor must obtain certification from the abrasive supplier that the abrasive meets the above requirements. Some specific examples of commonly used and approved abrasives are as follows:
  - Black Beauty® Coal Slag
  - DuPont Starblast®
- (5) Abrasive particle size and size distribution shall be selected to ensure that the specified anchor pattern is achieved under anticipated blasting conditions.
- (6) Abrasive blast materials shall not be recycled.
- (7) OSHA approved fresh air fed blasting helmets shall be utilized for all abrasive blasting operations including PPE (i.e., respirators) for personnel in the blast area (~100' radius) that could be exposed to free abrasive dust.
- (8) Compressors and blasting equipment shall have all appropriate moisture and oil traps, regulators, and gauges and shall be in good working order. Qualified Inspector may perform blotter tests as outlined in ASTM D4285 Standard Test Method for Indicating Oil or Water in Compressed Air as required to assure clean, dry air. The blotter test can be performed by directing a strong stream of compressed air at a clean white absorbent material. No oil, water, or discoloration is to be visible. Test the air at a point downstream of oil traps and dryers. This test should be performed at least daily and more often if deemed necessary.
- (9) The minimum required working pressure at the blasting nozzle is 90 psig.

- (10) The minimum required manufacturer's rated new blasting nozzle capacity is 200 CFM for one working nozzle, 150 CFM per nozzle for two nozzles, and 125 CFM per nozzle for three or more nozzles in active use on the same air compressor.
- (11) The Contractor's air compressor capacity as rated by the manufacturer shall be 150 percent of the combined manufacturer's rated capacity of working nozzles in new condition.
- (12) The abrasive blasting pot shall have an inlet, outlet, or depressurizing valve, choke or bypass valve, and an abrasive control valve. All these valves are to be normally controlled manually. The blasting pot air inlet and the outlet valve may be remote-controlled by the blasting nozzle operator pneumatically or by electric means with electrical equipment rated for use in a Class I Division 2 area.
- (13) Blasting pots shall be designed, constructed, and stamped in accordance with the ASME pressure vessel code. The abrasive blasting pot must be equipped with a pressure relief valve set to prevent over-pressuring the vessel.
- (14) Air hose from compressor to abrasive pot shall not be less than 1-1/4 inch ID. Air abrasive hose from abrasive pot to nozzle shall not be less than 1 inch ID. Abrasive blast pots shall be plumbed with minimum 1-1/4 inch diameter pipe. Hose shall be of the shortest possible length to avoid loss of pressure and efficiency.
- (15) Venturi-type nozzles shall be used. Orifice size will depend on shape and surface to be cleaned, and must not be too large for the compressor used. A nozzle that has been worn to 125 percent of the original size shall be replaced.
- (16) All blast cleaning nozzles shall be equipped with an operating valve that must be held open manually (dead-man valve). Any means used to defeat the manual function of the valve (tying/taping/etc.) are prohibited.
- (17) The blasting equipment – including air compressor, abrasive blast pot, hose couplings, and blasting nozzle – shall be grounded with an insulated flexible #16 or larger copper conductor wire.
- (18) The surface profile of blasted surfaces shall be inspected prior to the application of the coating using Testex Press-O-Film replica tape. Use according to the manufacturer's instructions. The profile depth must be as specified in the coating manufacture's product data sheet and/or this specification.
- (19) All accessible weld flux and spatter shall be removed by hand scraping, followed by abrasive-blast cleaning or wire brushing.
- (20) Abrasive blast cleaning operations shall not be performed on surfaces that may be contaminated or wet after blasting and before coating, unless otherwise stated.
- (21) After abrasive blast cleaning is completed, all abrasives, dust, and other loose material shall be removed. The surface must not display effects of contaminants or flash rusting.
- (22) Surfaces that are abrasive blasted using a non-approved abrasive shall be re-blasted with the proper abrasive at no additional cost to Company.

### 5.3. Recoat - Pipe Examination

- (1) Qualified Inspector(s) shall perform an inspection of the steel surface, including – but not limited to – visual and NDT methods. All inspections shall be performed after the coating has been removed and the surface cleaned.
- (2) Pipe defects found after coating removal shall be evaluated and repaired, as appropriate, as determined by the qualified Inspector(s), in accordance with Company's compliance procedures. Any defect requiring repair/removal from the pipeline shall be marked and left open. Surface imperfections that may impair coating quality shall be removed by grinding prior to coating application.



## 5.4. Recoat - Coating Application

### 5.4.1. General

- (1) Surfaces to be coated shall be clean, dust free, and dry, and shall meet all surface preparation requirements before coating application.
- (2) All coating materials shall be furnished in the original manufacturer's unopened containers, clearly identified, and stored in accordance with the manufacturer's recommendation. Materials exceeding manufacturer's recommended shelf life, or which may exceed the shelf life before use, shall not be used, and shall be removed from the job site.
- (3) Each component shall be thoroughly mixed and blended separately, and blended components also blended before and during the coating process as necessary to ensure that the pigments, vehicles, and thinners are thoroughly mixed. The mixed coatings shall be continuously stirred by mechanical spray pot agitators or by other means if specified by the manufacturer. All mixing shall be performed in clean containers that are free from traces of grease, other coatings, or other contaminants. All containers shall be kept covered to prevent contamination.
- (4) All coating shall be applied in compliance with the coating manufacturer's specifications, and the material and application temperatures shall be within the manufacturer's recommended range.
- (5) Coating shall not be spray applied in windy conditions unless approved by qualified Inspector(s).
- (6) Primer shall be dry to touch or per manufacturer's recommendations before the applicable tape system is applied.

### 5.4.2. Liquid Coatings

#### 5.4.2.1. Airless Spray Application

- (i) Airless tips shall be of proper size and fan angle, as recommended by the manufacturer of the coating being applied and of the equipment being used.
- (ii) Airless spray equipment shall be equipped with an electric ground wire in the high-pressure line between the gun and the pumping equipment. The pumping equipment shall be properly grounded to avoid build-up of static charge on the gun.

#### 5.4.2.2. Plural Component Spray Application

Plural component spray equipment shall be equipped with an electric ground wire in the high-pressure line between the gun and the pumping equipment. The pumping equipment shall be properly grounded to avoid build-up of static charge on the gun. Recommend flushing hoses within 3 – 4 minutes of completion of application.

#### 5.4.2.3. Brush and Roller Application

- (iii) Brushes and rollers shall be of style, size, and quality to enable proper application of coating according to manufacturer's recommendation. The coating shall be applied with the conformity and thickness specified.
- (iv) Coating shall be free of bubbles, runs, drips, foreign matter, and other anomalies.

#### 5.4.2.4. Rock Shield

At the discretion of qualified Inspector(s), rock-shield material may be employed and installed by Contractor in lieu of select backfill. Rock shield that impedes the flow of cathodic protection current shall not be used. Company qualified Inspector shall designate the rock-shield material in these instances.



### 5.5. Recoat - Coating Inspection and Cure Time

- (1) Coating shall be allowed to cure adequately before the structure is handled or backfilled. Not following the manufacture recommendations may cause severe immediate degradation of the newly applied coating.
- (2) Time interval between application and backfill shall be controlled within the limits recommended by the coating supplier. The nondestructive test method that shall be periodically conducted to determine if the coating is backfill ready is the Shore D Hardness Test as referenced in NACE RP0105 Liquid-Epoxy Coatings for External Repair, Rehabilitation, and Weld Joints on Buried Steel Pipelines Section 8.2.5.4.2. Minimum Shore D hardness requirements shall be as indicated in Tables 9.2 and 9.3 of this standard.
- (3) Inspection results must be documented on the Company STD.7004 (Below Ground) Coating Inspection Report or other approved document.
- (4) Should any of the following conditions not be met, the Contractor shall recoat the coated pipe:
  - (a) Coating shall be free of bubbles, runs, drips, foreign matter, and other anomalies.
  - (b) Cured coating shall be of uniform color, gloss, and thickness and shall be free of blisters, pinholes, craters, fish eyes, sags, and other irregularities or anomalies.

### 5.6. Recoat - Holiday Detection

- (1) Holiday inspection for all other buried or submerged pipeline coatings shall be in accordance with the Manufacture's recommendations as listed in Table 9.3.
- (2) One-hundred percent of the coated surface shall be holiday inspected. Holiday inspection shall be conducted just prior to lowering the pipe into the ditch or submerging or backfilling the pipe. Any coating damage discovered must be repaired. All inspection and repair results must be documented on the Company Coating Inspection form.
  - (a) The detector shall be equipped with a visual and/or audible alarm to signal current flow through the apparatus.
  - (b) To verify test voltages for all buried or submerged pipeline coatings, reference the Manufacture's recommendation and Table 9.3 of this document.
- (3) Holiday detection voltage settings are established based upon the Manufacturer's recommendation as listed in the tables included in Section 9 of this Standard.

### 5.7. Recoat - Backfill

Backfilling shall be completed per Company procedures. At a minimum, care must be taken to insure that the backfill material contains no rocks or debris that could possibly damage the coating.

## 6.0 MINOR COATING REPAIRS (PATCHING)

### 6.1. General

- (1) Contractor shall handle pipe in such a way that no coating damage results; however, Contractor shall repair all coating defects detected, including those caused by Contractor's handling or neglect.
- (2) Surfaces to be coated shall be clean, dust free, and dry, and shall meet all surface preparation requirements before coating application.
- (3) All coating materials shall be furnished in the original manufacturer's unopened containers, clearly identified, and stored in accordance with the manufacturer's recommendation. Materials exceeding manufacturer's recommended shelf life, or which may exceed the shelf life before use, shall not be used, and shall be removed from the job site.

- (4) Each component shall be thoroughly mixed and blended separately, and blended components also blended before and during the coating process as necessary to ensure that the pigments, vehicles, and thinners are thoroughly mixed. The mixed coatings shall be continuously stirred by mechanical spray pot agitators or by other means if specified by the manufacturer. All mixing shall be performed in clean containers that are free from traces of grease, other coatings, or other contaminants. All containers shall be kept covered to prevent contamination.
- (5) All coating shall be applied in compliance with the coating manufacturer's specifications, and the material and application temperatures shall be within the manufacturer's recommended range.
- (6) Coating shall not be spray applied in windy conditions unless approved by qualified Inspector(s).
- (7) Primer shall be dry to touch or per manufacturer's recommendations before the applicable tape system is applied.

## 6.2. Repairs to FBE

Damaged coating and pinholes and small defects detected by holiday testing shall be cleaned by removing all rust, scale, loose coating, dirt, or other foreign materials with hand or power-driven wire brushes (SSPC-SP2 or SP3). The area surrounding the repair shall also be suitably roughened, feathered, and cleaned for proper adhesion of the repair materials. Pipe surface imperfections – such as scales, slivers, burrs, and spatter from welding and torch cutting – shall be removed by grinding before coating repairs begin, and all debris wiped away with a dry cloth.

### 6.2.1. Single-Layer Fusion-Bonded Epoxy

- (1) Polymeric melt stick and patch compound
  - (a) Pinholes and small defects (1/4 inch diameter or 1/4 x 1/4 inches) shall be repaired with polymeric melt sticks or liquid epoxy.
  - (b) When using polymeric melt sticks, the area to be repaired shall be pre-heated in accordance with manufacturer's application specifications. While continuing to heat the area using any non-contaminated heat source, the patch compound shall be applied by rubbing the stick on a heated steel surface, using a circular motion to achieve a smooth patch that overlaps the surrounding undamaged coating by 1/2 inch. Repairs shall be allowed to cool before electrical holiday testing.
- (2) Liquid Epoxy
  - (a) Coating defects exceeding the dimensions outlined in section 6.2.1(1)(a) shall be repaired with liquid epoxy.
  - (b) The pipe to be repaired shall be cleaned to remove all dirt, scale, rust, damaged, or disbanded coating, and other foreign material. Damaged areas shall be suitably roughened using a power-driven wire brush or sandpaper, and adjacent coating shall also be roughened to receive coating for a distance of approximately 2 to 2-1/2 inches. Dust generated by brushing or sanding shall be removed with a clean dry cloth or brush prior to application of coating. The edges of the original coating shall be "feathered out" around the area to be coated and all dust wiped off before applying the patch coating.
  - (c) The material for patch coating shall be a 100 percent solid, catalytically-cured epoxy coating approved by Company Project Manager and applied in accordance with coating manufacturer's recommended procedures.
  - (d) The freshly-coated area shall be allowed to properly cure prior to inspection, backfill, or handling of the coated pipe. Care shall be taken to avoid blistering or bubbling of the coating film. Repairs shall be allowed to cure before electrical holiday testing. Dry film thickness shall match the guidelines specified in the manufacturer's product data sheet.

### 6.3. Repairs to Fusion-Bonded Epoxy with Abrasion-Resistant Overlay (ARO)

The patch-stick (melt-stick) method or cold-applied tapes shall not be used to repair ARO coating damage.

#### 6.3.1. Liquid Epoxy

- (1) Pipe with unacceptable coating thickness, disbanded, or delaminated coating and pipe that does not meet hardness requirements shall be cleaned using a method that will not damage the first layer, primary corrosion coating or the pipe. If the corrosion coating is damaged during removal of ARO coating, Contractor shall be responsible for recoating the pipe to these specification standards at no cost to Company.
- (2) Defective and damaged areas shall be suitably roughened using a power-driven wire brush or sandpaper, and adjacent coating shall also be roughened to receive coating for a distance of approximately 2 to 2-1/2 inches. Dust generated by brushing or sanding shall be removed with a clean dry cloth or brush prior to application of coating.
- (3) Contractor shall apply SPC-2888 or Powercrete J material per manufacturer's recommended procedures, after approved by the Corrosion Prevention Supervisor or Manager, to achieve the same coating thickness as the original pipe coating thickness.
- (4) Patches shall overlap the surrounding undamaged coating by approximately 2 to 2-1/2 inches.
- (5) Repairs are subject to re-inspection at the discretion of qualified Inspector(s).
- (6) Repairs to other multi-layer coating shall be in accordance with coating manufacturer's recommended procedures.

### 6.4. Repairs to Cold Applied Tape

- (1) Cold applied tapes and coal tar mastics may be used for repairs of holidays and damaged areas of cold applied tape (polyolefin) coating. Cold applied tape may also be used to repair two and three-layer polyolefin coating systems.
- (2) For non-Recoat projects - Cold applied tapes may be used for repairs of holidays and damaged areas of cold applied tape (polyolefin) coating. Cold applied tape may also be used to repair two and three-layer polyolefin coating systems.
- (3) Disbonded tape shall not be repaired. It shall be removed and recoated per section 5.0 of this standard.

#### 6.4.1. Cold-Applied Tape

- (1) The surface to be repaired shall be cleaned to remove oil, grease, mud, and dirt; mud and dirt shall be removed by washing or hand cleaning, and oil and grease shall be removed with non-oily environmentally-safe solvent and clean rags. Remove any rough, protruding damaged coating that may penetrate the tape or sleeves by abrading, filing, or cutting the material. Using hand or power-driven wire brushes abrade exposed pipe surface and adjacent coating at least 1 inch beyond the holiday or damaged area. Clean the entire area of the pipe to be primed so that it is free of contamination and moisture.
- (2) Prime the entire repair area in accordance with selected manufacturer's recommended procedures. Priming should extend approximately 3 inches on all sides of the holiday or edge of the damaged coating.
- (3) Primer shall be applied to the bonded tape surface around the damaged area and around the circumference of the pipe, and then the repair shall be made by spiral wrapping the tape over the entire repair area.
- (4) Starting approximately 3 inches before the holiday or edge of the damaged coating, use an approved wrapping method/apparatus to wrap the tape spirally around the pipe with a 50 percent overlap (double wrap), continuing approximately 3 inches past the holiday or edge of the

damaged coating. Follow manufacturer's recommendation for apparatus adjustments to achieve proper tension and neck down.

- (5) The repair area shall be holiday tested and visually inspected for air entrapment.

#### **6.4.1.1. Definition of Tape Applications**

- (i) Machine-applied tape systems are those applied by a powered machine; manually applied tape systems are those tapes that are applied by hand or by using a hand wrapster machine.
- (ii) Because of the potential to damage and disbonded old coating, the coating machine shall not be run over the old coating system. At start and end points, coating shall be removed evenly around the pipe. The existing coating shall be cleaned to a minimum of 12 inches back from the cut end and tapered as conditions allow. The transition tape material shall be applied over the cleaned area by hand or by using a hand-held tape applicator. If hand wrapped, extra careful attention must be given to ensure that the tape is applied with sufficient tension to achieve sag and wrinkle free condition. If applied by hand, the hand held tape applicator machine is the preferred method.
- (iii) Any areas skipped due to temporary pipe supports shall be wrapped by machine or by the hand-applied tape system.
- (iv) Tape shall be handled in a manner to prevent damage to tape ends and cores. To prevent deformity and other damage to coating, cases are limited to a height of 6 feet. Qualified Inspector(s) shall have the option of having the number of cases in a stack reduced if there is evidence of coating damage.
- (v) The storage and/or staging site shall be laid out to permit ingress and egress and to allow for maneuvering of equipment in a safe manner. The site shall be covered to prevent stored material from contacting earth or liquids and to prevent ultraviolet light degradation. The site shall be maintained free of debris and in compliance with environmental and drainage requirements of local and/or state agencies. All materials shall be stored in accordance with manufacturer's recommendations, including temperature requirements.
- (vi) All cold-applied tapes to be applied over steel surfaces shall have a minimum surface preparation abrasive-blast cleaned to a commercial blast finish (NACE #3/SSPC-SP6). Power brushing is not permitted.

#### **6.4.1.2. Joint or Seam Tape**

As per manufacturer's recommendation, the primer shall be dry to touch before applying the tape. Apply the seam tape by hand over the longitudinal seam and girth weld with sufficient tension to achieve a wrinkle-free condition.

#### **6.4.1.3. Primer**

The manufacturer's recommended primer and primer application shall be used for the tape system being applied. Surface preparation (see Section 5.2 of this standard), application and primer thickness shall be per manufacturer's recommendation.

#### **6.4.1.4. Single-Wrap Tape**

The tape shall be spirally applied, smooth and wrinkle free, by an approved wrapping method/machine. Manufacturer's recommendations for machine adjustments shall be followed to achieve proper tension and neck down. A 50 percent overlap is required for all spiral wrappings.

**6.4.2. Coal Tar Mastic**

- (1) After cleaning and preparing as specified in Section 5.2 above, coal tar mastic may be used to repair small holidays or damaged coating areas less than 4 square inches.
- (2) Apply a thin coat of Polyguard CA-9 Mastic, approximately 10 mils wet film thickness (WFT), to the prepared area and extend a minimum of 3 inches, in all directions, beyond the holiday or damaged coating area. Allow the first coat to dry to the touch. Apply a second coat of the Polyguard CA-9 Mastic with a Wet Film Thickness (WFT) of approximately 10 mils. The total Dry Film Thickness (DFT) should be approximately 12 mils.
- (3) Where prompt backfilling is required, prepare the entire circumference of the pipe, and apply Polyguard CA-9 to the prepared area. Apply Polyguard 400 Wrap over the first coat of mastic. The second coat of mastic shall be applied over the 400 Wrap, which will remain as reinforcement in the coating. After the second coat of mastic is applied, another layer of 400 Wrap shall be applied to the exterior surface. Caution should be taken not to pull the 400 Wrap through the mastic onto the pipe surface. Use very little tension during application.

**7.0 TEST LEAD AND/OR CABLE ATTACHMENT****7.1. General**

- (1) All test leads and/or cable attachments shall be prepared and coated in three ways, as discussed below.
- (2) Clean and prepare areas around the wire attachment in accordance with SSPC SP-2 or SP-3.
- (3) Any exceptions or deviations from the approved materials, coating systems, and procedures must be approved by the local area Corrosion Prevention Manager or Supervisor.

**7.2. Option 1**

- (1) Brush apply thin coat of Polyguard CA-9 Mastic over the cad weld area, exposed steel surface and extend at least 3 inches past the repair area to cover the adjacent coating. Careful attention shall be given to completely cover all cracks and crevices around the cad-weld and existing coating. Allow drying to the touch.
- (2) Fill thermite-weld cap (plastic cap only, no mastic) with Polyguard CA-9 Mastic and apply over the previously coated square.
- (3) Press the cap so as to squeeze the mastic inside, onto, and around the wire and pipe surface. The tunnel portion of the cap permits the test station wire to exit the cap while the rest of the cap remains flush to the pipe surface. An optional third coat can be applied over the entire application area. Mastics are subject to displacement or damage from backfill. Therefore, it is a good practice to let each coat of mastic dry as much as possible prior to backfilling to minimize this occurrence. Extra care must be exercised during backfill to avoid dumping heavy loads of dirt or clumps of soil and rock directly on the coated area.

**7.3. Option 2**

Liquid epoxy coating can be used on FBE- and liquid-coated pipe in accordance with manufacturer's recommendations. Care must be given to ensure that original anchor profile is maintained in an effort to ensure proper bonding of the liquid epoxy.

**7.4. Option 3**

Handi-Cap and compatible primer can be used in accordance with manufacturer's recommendations. Care must be given to ensure that original anchor profile is maintained in an effort to ensure proper bonding of the primer.

## 8.0 DOCUMENTATION

- (1) Pipeline new construction, recoating, and repair protective coating projects shall be documented in the following locations:
  - (a) Project Folder
  - (b) Form #140 Maintenance Report
  - (c) STD.7004 (Below Ground) Coating Inspection Report or other approved document
  - (d) Pipeline alignment sheets
  - (e) The appropriate database
- (2) Data to be documented will include the following:
  - (a) Asset identification (pipeline number, station name, etc.)
  - (b) Project identification (project number)
  - (c) Coating system(s) utilized and system selection considerations
  - (d) Coating Contractor(s) used
  - (e) Coating application details
  - (f) Inspection data
  - (g) Project summary report

## 9.0 APPROVED MATERIALS AND COATING SYSTEMS

- (1) The approved coatings matrix shall be utilized in Table 9-1 below.
- (2) Approved materials and coating systems shall be as defined in the Tables below, from preferred to least desirable:
  - (a) Table 9-2 – Fusion Bonded Epoxy
  - (b) Table 9-3 – Liquid Epoxy Coatings
  - (c) Table 9-4 – Fusion-Bonded Epoxy Repair Systems
  - (d) Table 9-5 – Cold-Applied Tape
  - (e) Table 9-6 – Coal Tar Mastic
  - (f) Table 9-7 – Coal Tar Enamel
- (3) Approved project types shall be defined in the Tables below:
  - (a) Yes = is approved for the project type application
  - (b) No = is not approved for the project types application
- (4) The type of protective coating to be used will be specified in the purchase order or construction contract.
- (5) Contractor must obtain the specified materials from one of the approved manufacturers listed in the tables below.
- (6) Any exceptions or deviations from the approved materials, coating systems, and procedures must be approved by the local area Corrosion Prevention Manager or Supervisor.

**Table 9-1: Approved Coatings Matrix**

<b>Coating Type</b>	<b>Project Type</b>			
	<b>Field Joint (New Construction)</b>	<b>Recoat (Existing Coating Removal)</b>	<b>Minor Coating Repair (Patch)</b>	<b>Test Lead and/or Cable Attachment</b>
Fusion Bonded Epoxy	Yes	No	No	No
Liquid Epoxy Coatings	Yes, (some products) <sup>1</sup>	Yes	Yes	Yes, (most products) <sup>1</sup>
Fusion- Bonded Epoxy Repair System	No	No	Yes, only on FBE	No
Cold Applied Tape	No	No	Yes	No
Coal Tar Mastic	No	No	Yes	Yes
Coal Tar Enamel	No	No	Yes	No

Note 1: See application notes below for approved products.



<b>Company:</b> <b>3M Company</b> 3M Austin Center Bldg. 6801 River Place, 130-3N-54 Austin, TX 78726-9000		
<b>Contact:</b> <b>Sales - Jeff Fargerson</b> Mobile: (713) 385-3704		<b>Business Development – Jeff Wilkins</b> Direct: (512) 984-5684 Mobile: (512) 789-6461 Email: <a href="mailto:jbwilkins@mmm.com">jbwilkins@mmm.com</a>
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application and Inspection Notes</b>
3M Scotchkote 6233P 4G, 8G, and 11G	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes                  Minor Coating Repair – No Recoat – No                          Test Lead – No  <b>Application Notes:</b> Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, Section 3.5:             <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>

<b>Company:</b> Valspar  <b>Contact:</b> Timothy Hanratty Mobile: (281) 904-5521 Phone: (713) 473-7230 Email: tim.hanratty.sherwin.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Valspar Pipeclad 2000 – Fast Gel (For diameters 22 in and less)	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – No Recoat – No              Test Lead – No  <b>Application Notes:</b> Diameters 22 in or less. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, Section 3.5:             <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>
Valspar Pipeclad 2000 – Slow Gel (For diameters greater than 22 in)	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – No Recoat – No              Test Lead – No  <b>Application Notes:</b> For diameters greater than 22 in. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, section 3.5:             <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>

<b>Company:</b> AXALTA (Formerly DuPont)		
<b>Contact:</b> Sales – Amber Anderson Mobile: (281) 414-0349 Email: amber.anderson@axalta.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application and Inspection Notes
Nap-Gard 7-2500 Color: Reddish Brown (For all diameters)	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – No Recoat – No              Test Lead – No  <b>Application Notes:</b> For all diameters. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 85 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, Section 3.5: <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>
Nap-Gard 7-2508 Series Color: Green (For all diameters)	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – No Recoat – No              Test Lead – No  <b>Application Notes:</b> For all diameters. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 85 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, section 3.5: <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>

Nap-Gard 7-2501 (For diameters 20 in and less)	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<p><b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – No Recoat – No              Test Lead – No</p> <p><b>Application Notes:</b> For diameters 20 in and less. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures &lt; 150°F, 18 – 26 mils for in-service temperatures &lt; 180°F.</p> <p><b>Inspection:</b></p> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 85 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) by NACE SP0490, section 3.5:             <ul style="list-style-type: none"> <li>○ 2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>○ 2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>
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<b>Company:</b> Akzo Nobel 20 Culvert Street Nashville, TN 37210  <b>Contact:</b> Sales – Joe Glassco Mobile: (615) 440-7358 Email: joseph.glassco@akzonobel.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Akzo Nobel Resicoat R-726A	SSPC-SP10 (NACE #2) 2 – 4 mil Profile  DFT: 15 – 22 mils, < 150°F 18 – 26 mils, < 180°F	<b>Application Type:</b> Field Joints – Yes <input type="checkbox"/> Minor Coating Repair – No <input type="checkbox"/> Recoat – No <input type="checkbox"/> Test Lead – No <input type="checkbox"/>  <b>Application Notes:</b> For all diameters. Primarily used for new construction field joints, 15 – 22 mils for in-service temperatures < 150°F, 18 – 26 mils for in-service temperatures < 180°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0490, section 3.5:             <ul style="list-style-type: none"> <li>2,250 (+- 10%) V for DFT: 15 - 22 mils</li> <li>2,500 (+- 10%) V for DFT: 18 - 26 mils</li> </ul> </li> </ul>

Table 9-3: Approved Liquid Epoxy Coatings

<b>Company:</b> Specialty Polymer Coatings, Inc. (SPC) 6202 Brookdale League City, TX 77573  <b>Contact:</b> Mike Musslewhite, Manager, Business Development, USA Office: (281) 595-3530 Mobile: (713) 503-8440 Email: mmusslewhite@spc-net.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application and Inspection Notes
SPC-2888 R.G. Epoxy/Urethane (brush grade)	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 20 – 50 mils (standard corrosion protection) 40-70 mils (directional and mechanical protection)	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> Preferred liquid epoxy coating system. Also approved for horizontal directional drilling/road bore, irregular shaped objects (e.g. valves and flanges)
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness of 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):               <ul style="list-style-type: none"> <li>4,375 V (minimum) for DFT: 20 - 50 mils</li> <li>6,875 V (minimum) for DFT: 40 - 70 mils</li> </ul> </li> </ul>
SPC-2888 R.G. Epoxy/Urethane (spray grade)	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 20 – 50 mils (standard corrosion protection) 40-70 mils (directional and mechanical protection)	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> Same as above but typically reserved for larger recoat projects (ex. >1,000 lineal feet of pipe)
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness of 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):               <ul style="list-style-type: none"> <li>4,375 V (minimum) for DFT: 20 - 50 mils</li> <li>6,875 V (minimum) for DFT: 40 - 70 mils</li> </ul> </li> </ul>

SPC-3888 Epoxy	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 20 – 50 mils	<p><b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes</p> <p><b>Application Notes:</b> For in-service temperatures up to 203°F. Not recommended for horizontal directional drilling/road bore applications</p> <p><b>Inspection:</b></p> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):             <ul style="list-style-type: none"> <li>○ 4,375 V (minimum)</li> </ul> </li> </ul>
SPC-4888 Damp Surface Epoxy	SSPC-SP10 (NACE #2) 2.5 – 3.5 mil Profile  DFT: 30 – 50 mils	<p><b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes</p> <p><b>Application Notes:</b> For in-service pipelines where the surface is damp due to high humidity or condensation. Not recommended for horizontal directional drilling/road bore applications</p> <p><b>Inspection:</b></p> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):             <ul style="list-style-type: none"> <li>○ 5,000 V (minimum)</li> </ul> </li> </ul>
SPC-8888 High Temperature Epoxy	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 30 – 60 mils	<p><b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes</p> <p><b>Application Notes:</b> For in-service temperatures up to 302°F. Not recommended for horizontal directional drilling/road bore applications</p>



		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT): <ul style="list-style-type: none"> <li>5,625 V (minimum)</li> </ul> </li> </ul>
SPC-2831 Low Temperature Epoxy	SSPC-SP10 (NACE #2) 2.5 – 5.0 mil Profile  DFT: 20 – 50 mils	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> For cool weather applications. Ability to cure in temperatures down to 32°F. Not recommended for horizontal directional drilling/road bore applications.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT): <ul style="list-style-type: none"> <li>4,375 V (minimum)</li> </ul> </li> </ul>

<b>Company: 3M Company</b> 3M Austin Center Bldg. 6801 River Place, 130-3N-54 Austin, TX 78726-9000		
<b>Contact: Sales - Jeff Fargerson</b> Mobile: (713) 385-3704		
<b>Business Development – Jeff Wilkins</b> Direct: (512) 984-5684 Mobile: (512) 789-6461 Email: jbwilkins@mmm.com		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application and Inspection Notes</b>
3M Scotchkote 323	SSPC-SP10 (NACE #2) 1.5 – 4 mil Profile  DFT: 25 – 50 mils	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> Preferred liquid epoxy coating system. 100% solids, two component, high build, high performance liquid epoxy coating. Approved for pipeline recoat projects, coating irregular shaped objects (e.g. valves and flanges).
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 70 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):             <ul style="list-style-type: none"> <li>4,688 V (minimum)</li> </ul> </li> </ul>
3M Scotchkote Abrasion Resistant Epoxy 328	SSPC-SP10 (NACE #2) 1 – 4 mil Profile  DFT: 20 – 50 mils (Standard corrosion protection)	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> Preferred liquid (ARO) epoxy coating system. 100% solids, two component, high build, high performance, ambient cured liquid epoxy coating. Enhanced abrasion resistance properties with high flexibility. Approved for pipeline horizontal directional drilling/road bore pipeline projects.

	40 – 80 mils (Directional bore protection as an ARO)	<b>Inspection:</b> <ul style="list-style-type: none"><li>• Minimum Shore D hardness: 70 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li><li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):<ul style="list-style-type: none"><li>○ 4,375 V (minimum) for DFT: 20 – 50 mils</li><li>○ 7,500 V (minimum) for DFT: 40 – 80 mils</li></ul></li></ul>
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<b>Company:</b> <b>Seal for Life Industries</b> 25 Forge Pkwy Franklin, MA 02038 Corporate: 508-918-1900 www.sealforlife.com		
<b>Contact:</b> <b>Cindy Patton</b> (713) 623-3929 Email: cindypatton@berryplastics.com <b>Angela Rose</b> Mobile: (281) 732-3948 Email: arose@pipelinesupply.com		
<b>Technical Representative:</b> <b>Aaron Schiflett</b> Mobile: (832) 567-0465 Email: aaronshiflett@berryplastics.com		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Powercrete J	SSPC-SP10 (NACE #2) 2.5 – 4 mil Profile  DFT: 20 – 50 mils (Standard corrosion protection)  30 – 80 mils (Directional bore protection as an ARO)	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – No  <b>Application Notes:</b> Also approved for horizontal directional drilling/road bore, irregular shaped objects (e.g. valves and flanges)
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 75 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT): <ul style="list-style-type: none"> <li>4,375 V (minimum) for DFT: 20 - 50 mils</li> <li>6,875 V (minimum) for DFT: 30 – 80 mils</li> </ul> </li> </ul>
Powercrete R65/F1	SSPC-SP10 (NACE #2) 3 – 4 mil Profile  DFT: 20 – 80 mils	<b>Application Type:</b> Field Joints – Yes      Minor Coating Repair – Yes Recoat – Yes      Test Lead – Yes  <b>Application Notes:</b> 100% solids, two component, high build, high performance liquid epoxy coating. Approved for pipeline recoat projects, coating irregular shaped objects (e.g. valves and flanges).

		<p><b>Inspection:</b></p> <ul style="list-style-type: none"><li>• Minimum Shore D hardness: 75 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li><li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (average specified DFT):<ul style="list-style-type: none"><li>○ 6,250 V (minimum)</li></ul></li></ul>
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<b>Company:</b> <b>Denso</b> 9747 Whithorn Drive Houston, TX 77095 www.densona.com  <b>Contact:</b> <b>Steve Baker</b> Office: (281) 821-3355 Mobile: (713) 412-3097 Email: sbaker@densona.com		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Denso Protal 7200 Brush/Spray Grade	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 20 – 50 mils (Standard corrosion protection)  40 – 70 mils (Directional bore protection)	<b>Application Type:</b> Field Joints – Yes            Minor Coating Repair – Yes Recoat – Yes                Test Lead – Yes  <b>Application Notes:</b> Also approved for irregular shaped objects (e.g. valves and flanges). For transitional areas (i.e. from below to above ground) and below grade fittings that require routine access.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 70 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (minimum specified DFT): <ul style="list-style-type: none"> <li>○ 2,500 V (minimum) for DFT: 20 - 50 mils</li> <li>○ 5,000 V (minimum) for DFT: 40 – 70 mils</li> </ul> </li> </ul>
Denso Protal 7125 Brush Grade, Fast Cure, Low Temperature	SSPC-SP10 (NACE #2) 2.5 – 5 mil Profile  DFT: 20 – 50 mils	<b>Application Type:</b> Field Joints – Yes            Minor Coating Repair – Yes Recoat – Yes                Test Lead – Yes  <b>Application Notes:</b> Also approved for irregular shaped objects (e.g. valves and flanges). Only to be used when cold weather applications are required (below 40°F). Ability to cure in temperatures down to -4°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 70 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 125 V / mil (minimum specified DFT): <ul style="list-style-type: none"> <li>○ 2,500 V (minimum)</li> </ul> </li> </ul>

<b>Company:</b> <b>The Sherwin-Williams Company</b> 10132 Buxton Houston, TX 77017  <b>Contact:</b> <b>Tim Hanratty</b> Mobile: (281) 904-5521 Email: tim.hanratty@sherwin.com		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Sherwin-Williams Pipeclad 5000	SSPC-SP10 (NACE #2) 2.5 – 4.5 mil Profile  DFT: 25 – 60 mils	<b>Application Type:</b> Field Joints – Yes            Minor Coating Repair – Yes Recoat – Yes                    Test Lead – Yes  <b>Application Notes:</b> Ultra high solids amine cured epoxy phenolic novolac engineered, 99% solids, two component, high build, high performance liquid epoxy coating. Approved for buried pipeline recoat projects, coating irregular shaped objects (e.g. valves, fittings and flanges).
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 70 before backfill and/or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Minimum holiday testing voltage (V) based on the Manufacturer's recommendation of 100 V / mil (average specified DFT):             <ul style="list-style-type: none"> <li>○ 2,650V (minimum)</li> </ul> </li> </ul>



<b>Company:</b> <b>PPG Protective and Marine Coatings</b> 2440 East Freeway Pasadena, TX 77506 <b>Contact:</b> <b>Kevin Kelleher - Senior Technical Sales Rep.</b> Main: (713) 823-2857 Email: kevin.kelleher@ppg.com		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Amerlock 400 and 400-2 (fast cure) with Amercoat 880 Glassflake additive	SSPC-SP10 (NACE #2) 1 - 5 mil Profile  DFT: 12 - 16 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – Yes                              Test Lead – Yes <b>Application Notes:</b> High Solids Epoxy. Also for irregular shaped objects (e.g. valves and flanges) and below grade fittings that require routine access. For transitional areas (i.e., from below to above ground). Amercoat 880 Glassflake additive required for all transitional areas and below grade applications.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 80 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0188 (wet sponge), as per Manufacture's recommendation: <ul style="list-style-type: none"> <li>67.5 V (minimum)</li> </ul> </li> </ul>

<b>Company:</b> <b>Carboline Company</b> 350 Hanley Industrial Ct. St. Louis, MO 63144-1599  <b>Contact:</b> <b>John Byrd</b> Office: (918) 299-6628 Mobile: (918) 630-4005		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Carboline 300M	SSPC-SP10 (NACE #2) 2 – 3 mil Profile  DFT: 20 – 35 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – Yes                          Test Lead – Yes  <b>Application Notes:</b> Coal Tar Epoxy. Also for coating, irregular shaped objects (e.g. valves and flanges), and below grade fittings that require routine access. Not for transitional areas (i.e., from below to above ground).
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 75 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>• Please Note: Coal Tar Epoxy coating requires extended period of curing time to achieve the minimum 75 Shore D hardness before backfill and or handling (as periodically tested), as per the Manufacture's recommendation.</li> <li>• Minimum holiday testing voltage (V) by NACE SP0188, as per Manufacturer's recommendation: <ul style="list-style-type: none"> <li>○ 3,000 V (minimum)</li> </ul> </li> </ul>

<b>Company:</b> International Paint Inc. 6001 Antoine Drive Houston, TX 77091 <b>Contact:</b> Doug Sinitiere - Business Development - Protective Coatings Office: (713) 684-1340 Cell: (403) 464-8021 E-mail: doug.sinitiere@akzonobel.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Enviroline 376F-30	SSPC-SP10 (NACE #2) 3 - 5 mil Profile  DFT: 20 – 40 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – Yes                              Test Lead – Yes <b>Application Notes:</b> Liquid epoxy novolac coating system. Approved for pipeline recoat projects, coating irregular shaped objects (e.g. valves and flanges).
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 75 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0188, as per Manufacturer's recommendation:             <ul style="list-style-type: none"> <li>3,000 V (minimum)</li> </ul> </li> </ul>
Enviroline 376F-30LT, Low Temperature	SSPC-SP10 (NACE #2) 3 - 5 mil Profile  DFT: 20 – 40 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – Yes                              Test Lead – Yes <b>Application Notes:</b> Liquid epoxy novolac coating system. Approved for pipeline recoat projects, coating irregular shaped objects (e.g. valves and flanges). Only to be used when cold weather applications are required (below 40°F). Ability to cure in temperatures down to 20°F.
		<b>Inspection:</b> <ul style="list-style-type: none"> <li>Minimum Shore D hardness: 75 before backfill and or handling (as periodically tested), as per the Manufacturer's recommendation.</li> <li>Minimum holiday testing voltage (V) by NACE SP0188, as per Manufacturer's recommendation:             <ul style="list-style-type: none"> <li>3,000 V (minimum)</li> </ul> </li> </ul>

<b>Company:</b> International Paint Inc.  <b>Contact:</b> Chuck Stollenwerck Mobile: (713) 408-7592 Email: Chuck.Stollenwerck@akzonobel.com		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Devlar 5A	SSPC-SP10 (NACE #2) 1.5 – 2.5 mil Profile  DFT: 12 – 16 mils	<b>Application Type:</b> Field Joints – No <input type="checkbox"/> Minor Coating Repair – Yes <input type="checkbox"/> Recoat – Yes <input type="checkbox"/> Test Lead – Yes <input type="checkbox"/>  <b>Application Notes:</b> Epoxy High Build Coating. Also for irregular shaped objects (e.g. valves and flanges). For transitional areas (i.e., from below to above ground) and below grade fittings that require routine access.  <b>Inspection:</b> <ul style="list-style-type: none"> <li>• Minimum Shore D hardness: 75 before backfill and or handling</li> <li>• Minimum holiday testing voltage (V) by NACE SP0188, as per Manufacture's recommendation:             <ul style="list-style-type: none"> <li>○ 67.5 V (minimum)</li> <li>○ (Low Voltage Wet Sponge)</li> </ul> </li> </ul>

Table 9-4: Approved Cold Applied Tape

<b>Company:</b> <b>Tapecoat Company</b> P.O. Box 631 Evanston, IL 60204-0631  <b>Contact:</b> <b>Katy Simon</b> Office: (847) 866-8500		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Tapecoat TC Omni-Prime	SSPC-SP6 (NACE #3)	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – No  <b>Application Notes:</b> Primer. Only for minor coating repairs. Maximum repair size per section 6.0.
Tapecoat M50 RC	SSPC-SP6 (NACE #3)	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – No  <b>Application Notes:</b> Tape. Only for minor coating repairs. Maximum repair size per section 6.0

<b>Company:</b> Polyguard Products, Inc. 5201 Mitchelldale Suite 12-B Houston, TX 77092 <b>Contact:</b> Chic Hughes - VP Pipeline Products Division Office: (713) 681-1743 FAX: (713) 681-1219		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Polyguard Liquid Adhesive 600 Primer	SSPC-SP6 (NACE #3)	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – No <b>Application Notes:</b> Primer. Only for minor coating repairs. Maximum repair size per section 6.0.
Polyguard RD-6 Coating	SSPC-SP6 (NACE #3)	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – No <b>Application Notes:</b> Tape. Only for minor coating repairs. Maximum repair size per section 6.0
Polyguard 606 Filler Tape	SSPC-SP6 (NACE #3)	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – No <b>Application Notes:</b> Filler. Only for minor coating repairs. Maximum repair size per section 6.0

Table 9-5: Approved Coal Tar Mastic

<b>Company:</b> Polyguard Products, Inc. 5201 Mitchelldale Suite 12-B Houston, TX 77092 <b>Contact:</b> Chic Hughes - VP Pipeline Products Division Office: (713) 681-1743 FAX: (713) 681-1219		
Coating Brand Name	Minimum Required Surface Preparation and DFT (min-max)	Application Notes
Polyguard CA-9	SSPC-SP2 or SSPC-SP3	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – Yes <b>Application Notes:</b> Coal Tar Mastic for test lead and/or cable attachments and small repairs (< 4 in <sup>2</sup> ) to damaged cold applied tapes
Polyguard 400 Wrap	N/A	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                              Test Lead – Yes <b>Application Notes:</b> Reinforcement and outer covering/protective wrapping for Polyguard Mastic when coating is to be backfilled with minimum time allowed for drying



Table 9-6: Approved Coal Tar Enamel

<b>Company:</b> <b>Reilly Industries</b> Hwy 259 South P.O. Box 247 Lone Star, TX 75668  <b>Contact:</b> <b>Sales - Charlie Forecast</b> <b>Technical - Kerry Hicks</b> Office: (317) 248-6479                      Office: (800) 236-2032		
<b>Coating Brand Name</b>	<b>Minimum Required Surface Preparation and DFT (min-max)</b>	<b>Application Notes</b>
Reilly Type 2 Fully Plasticized Coal Tar Enamel	SSPC-SP6 (NACE #3) 1.5 – 3.5 mil Profile 90 – 120 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                      Test Lead – No  <b>Application Notes:</b> Coal Tar Enamel (Hot Dope)
Reilly Synthetic Primer	SSPC-SP6 (NACE #3) 1.5 – 3.5 mil Profile 90 – 120 mils	<b>Application Type:</b> Field Joints – No                      Minor Coating Repair – Yes Recoat – No                      Test Lead – No  <b>Application Notes:</b> Reilly EP-10 Epoxy Primer will be used for services temps. >150°F

## 10.0 OVERLAP COATING

- (1) An overlap coating is the coating required to join to two different coating types together that butt up to one another.
- (2) This section only applies when two different coating types are required to be joined together. This section is not intended to be used for the overall selection of coating for the project.
- (3) The overlap coating types listed below in Table 10-1 shall be used.

**Table 10-1: Overlap Coating Matrix**

Transitioning from one coating type to another coating type:	Overlap Coating			
	Fusion Bonded Epoxy	Liquid Epoxy Coatings	Cold P/O Tapes	Coal Tar Enamel
From FBE to FBE	Yes	Yes	No	No
From FBE to Liquid Epoxy	Yes	Yes	No	No
From FBE to P/O	No	No	Yes	No
From FBE to P/O Tapes	No	No	Yes	No
From FBE to Coal Tar Enamel*	No	Yes	No	Yes
From FBE to Asphalt Tar Enamel*	No	Yes	No	Yes
From Liquid Epoxy to Liquid Epoxy	No	Yes	No	No
From Liquid Epoxy to P/O	No	No	Yes	No
From Liquid Epoxy to P/O Tapes	No	No	Yes	No
From Liquid Epoxy to Coal Tar Enamel*	No	Yes	No	Yes
From Liquid Epoxy to Asphalt Tar Enamel*	No	Yes	No	Yes
From P/O to P/O	No	No	Yes	No
From P/O to P/O Tapes	No	No	Yes	No
From P/O Tapes to Coal Tar Enamel*	No	No	Yes	No
From P/O Tapes to Asphalt Tar Enamel*	No	No	Yes	No
From Coal Tar Enamel* to Coal Tar Enamel*	No	Yes	No	Yes
From Coal Tar Enamel* to Asphalt Tar Enamel*	No	Yes	No	Yes
Asphalt Tar Enamel* to Asphalt Tar Enamel*	No	Yes	No	Yes

**NOTES:**

Liquid Two part liquid coatings

P/O Polyolefin (polyethylene, polypropylene, etc.; 3 layer)

\* For Coal Tar Enamels and Asphalt Tar Enamels, felt and craft paper outer wraps must be removed so joint coating can bond directly to underlying enamel base coating.

## Attachment Revision Log

Revision 0.0			Publish Date: 08 Feb 10
Location of Change	Type of Change	Reason for Change	
N/A	N/A		
Revision 1.0			Publish Date: 25 Feb 11
Location of Change	Type of Change	Reason for Change	
Section 1.4, 4.7 and 4.9.1.1 # 3	Correction	1.4 Corrected SSPC reference. 4.7 Corrected NACE reference and formula. 4.9.1.1 # 3 Removed temperature reference.	
Revision 1.1			Publish Date: 08 Sept 11
Location of Change	Type of Change	Reason for Change	
Section 1.2	Revision	Updated reference	
Revision 2.0			Publish Date: 07 May 13
Location of Change	Type of Change	Reason for Change	
Section 1.3	Addition	Added reference to SP-0490.	
Section 1.4, Section 2.3.1	Revisions	Added SP2 standard, Removed SP12 standard.	
Sections 4.1 to 2.1	Relocate	Moved Safety section from 4.1 to 2.1.	
Sections 2.1. to 2.2	Relocate	Moved General section from 2.1 to 2.2.	
Sections 2.1(9) to 2.6(7)	Relocate	Moved section from 2.1 (9) to 2.6 (7).	
Sections 4.0(1) to 2.3(1)	Relocate	Moved section from 4.0 (1) to 2.3 (1).	
Section 2.5	Addition	Added section 2.5.	
Sections 3.0 to 2.6	Relocate	Moved section from 3.0 to 2.6.	
Section 2.6	Revision	Changed name from “Coating Preferences” to “Coating Types”	
Section 2.6.1	Addition	Added “Fusion Bonded Epoxy” to list and prioritized list from “recommended” to “less preferred”. Added coating type definitions.	
Sections 2.7 to 2.8	Addition	Added sections 2.7 and 2.8.	

Sections 4.11 to 3.0	Relocate	Moved section from 4.11 to 3.0.
Section 3.1	Addition	Added sections 3.1 (1), (3), (5), (6), (7), (8), and (9).
Section 3.5	Revision	Removed previous verbiage and add new verbiage.
Sections 4.0, 5.0, 6.0, 7.0	Addition	Added new titles.
Sections 3.7 to 3.14	Relocate	Moved previous sections 3.7 through 3.14 into newly created section 4.0.
Sections 3.15 to 3.18	Relocate	Moved previous sections 3.15 through 3.18 into newly created section 5.0.
Sections 3.19 to 3.22	Relocate	Moved previous sections 3.19 through 3.22 into newly created section 6.0.
Section 3.23	Relocate	Moved previous sections 3.23 into newly created section 7.0.
Section 4.2(1)	Addition	Added section 4.2(1)
Section 4.7.1	Revision	Updated references.
Sections 5.4(1) to 5.4 (3)	Addition	Added sections 5.4(1), 5.4(2), and 5.4(3).
Section 7.0	Revision	Updated references and formatting.
Section 8.0	Addition	Added section.
Table 8-1	Addition	Added new table.
Tables 8-2 through 8-7	Revision	Divided original table into multiple tables. Updated information.
Section 9.0	Addition	Added new section and information.
Table 8-8	Revision	Updated table.
<b>Revision 3.0</b>		<b>Publish Date: 17 Sept 14</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 1.3	Revision	NACE RP0105 Added to the list
Section 2.2(8)	Clarification	Replaced “required” with “recommended” in general guideline statement regarding number of measurements.
Section 3.3.3(3)	Revision	Revised reference to surface preparation section from section 4.0 to section 3.3
Section 3.3.3(6)	Clarification	Revised content to clarify requirements
Section 3.4	Addition	Added section on cure time, and renumbered subsequent sections

Section 3.5.2(b) (previously section 3.4.2(f))	Revision	Revised section to add description of procedure used to determine hardness of field applied coating.
Section 3.6	Revision	Updated content on holiday detection.
Section 4.7	Revision	Updated content on holiday detection.
Section 5.1	Addition	Added content in sections 5.1(2) through 5.1(7)
Section 5.2.1(2)	Clarification/ Correction	Reworded content to clarify requirements; also corrected references to applicable sections of STD.7002
Table 8-2	Revision/ Addition	Updated product selections and Company contact information; Also added inspection notes.
Table 8-3	Revision/ Addition	Updated product selections and Company contact information; Also added inspection notes.
<b>Revision 3.1</b>		<b>Publish Date: 02 Oct 14</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 1.5	Addition	Added reference to Enterprise STD.7003
Section 2.2(16)	Deletion	Deleted “latest edition” after “API 1104.” The version of API 1104 incorporated by reference in 49 CFR 192 and 195 shall be used, as indicated in section 1.2 of this standard.
Section 3.4	Revision	Combined and updated sections on coating inspection and cure time, and renumbered subsequent sections
Section 4.5	Revision	Combined and updated sections on coating inspection and cure time, and renumbered subsequent sections
Sections 5.4.1.3 and 5.4.2	Update	Updated reference to surface preparation section in this standard from 4.3 to 4.2.
Table 8-2	Revision/ Addition	Updated product information and added inspection notes.
<b>Revision 3.2</b>		<b>Publish Date: 21 Oct 14</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 1.0, Table 1-3	Addition	Added NACE standard SP0188, “Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates”
Section 3.5(2)	Revision/ Addition	Deleted “NACE SP0274. This includes dual layer FBE coating systems and FBE with ARO”. Added “the Manufacturer’s recommendations as listed in Table 8.3.”
Section 3.5(4)(b)	Revision/ Addition	Deleted “procedure outlined in Section 7 of NACE SP0274” Added: “Manufacturer’s recommendations and Table 8.3 of this document.”

Section 3.5(5)	Revision/ Addition	Added “Manufacturer’s recommendation as stated in”
Section 3.5(5)(b)	Deletion	Deleted paragraph (b) and Example.
Section 4.6(1)	Revision/ Addition	Deleted “Holiday inspection shall be in accordance with NACE SP0274.” Added: “Holiday inspection for all other buried or submerged pipeline coatings shall be in accordance with the Manufacturer’s recommendations as listed in Table 8.3”
Section 4.6(2)(b)	Revision/ Addition	Deleted “procedure outlined in Section 7 of NACE SP0274.” Added “Manufacturer’s recommendation and Table 8.3 of this document.”
Section 4.6(3)	Revision/ Addition	Deleted “the average of the specified coating dry film thickness range” and “stated”. Added “the Manufacturer’s recommendation” and “listed,” respectively.
Section 4.6(3)(a)	Deletion	Deleted paragraph (a) and Example.
Section 7.0(1)(c)	Addition	Added “or other approved document.”
Table 8-1	Addition	Added “(some products) 1”, “(most products) 1”, and “Note 1: See application notes below for approved products”.
Table 8-2	Addition	Updated inspection notes by adding “, as per the Manufacturer’s recommendation” on all products.
Table 8-3	Revision/ Addition	Updated product information including Company contacts, surface preparation requirements, DFT ranges and minimum holiday testing voltages for all approved liquid epoxy coatings systems. These updates are based on the Manufacturer’s recommendations.
Table 8-3	Deletion	Deleted Company ICI Devco.
Table 8-3	Revision/ Addition	Product: Devtar 5A was added to the list of product provided by International Paint Inc.
<b>Revision 4.0</b>		<b>Publish Date: 19 Aug 19</b>
<b>Location of Change</b>	<b>Type of Change</b>	<b>Reason for Change</b>
Section 1.4	Addition	Added SSPC-SP16: Brush-Off- Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
Section 2.0	Addition	Definition Section was added.
Section 3.1	Deletion	Safety section was deleted. The number for the other sections were adjusted.
Section 3.1(3)	Revision	The section was revised for clarity.

Section 3.5	Addition	New paragraph with information regarding coating requirements on buried stainless steels and other non-ferrous metallic materials.
Table 9-2	Update	Product and contact information updated.
Table 9-3	Update	Product SW Fast Clad ER Epoxy was replaced by SW Pipeclad 5000.
Table 9-4	Deletion	Table deleted, Products discontinued and or/ not used.
Table 10-1	Update	Number corrected from “9-8”