· Final March 13, 2012 ·

Pipeline Construction:
Quality Issues and Solutions Action Plans

Field Applied Coatings Best Practices

The INGAA Foundation, Inc.

Field Applied Coatings Best Practices

Table of Contents

Team Members

Craig Linn, Williams[1]

Dave McQuilling, Southern Union [2]

Mike Adams, Valspar

Steve Baker, Denso

Robert Bendure, Sheehan Pipeline Construction

Matt Cetiner, TransCanada

Matt Dabiri, El Paso

Joe Glassco, Akzo Nobel

David Matlock, Williams

Chris McLaren, PHMSA Southwestern Region,

Craig Meier, Sunland Construction

Tracy Menard – Specialty Polymer Coatings

Mitch Pfeiffer, Commercial Coating Services

Greg Ruschau – ExxonMobil

Peter Singh, Bredero Shaw

Kuruvila Varughese, Dupont

Jeff Wilkins, 3M

[1] Working Group Lead
[2] Technical Leads
[3] Drafting Team

Section 1. General/Rationale

The proper application of fusion bond epoxy powder and liquid coatings in the field on a pipeline construction project, either on girth welds or various required repairs, is an essential element to the successful long–term integrity of a pipeline. There are numerous products and procedures used by the industry. The purpose of this work group is to document common-sense best practices in the form of a white paper for use by Operators, Material Suppliers, Applicators and Contractors (corrosion control personnel, design engineers, project managers, purchasers, and construction engineers and managers). It is applicable to immersion and underground steel pipelines with applied Cathodic Protection in the oil and gas gathering, distribution and transmission industries.

1.1. This document presents best practices for establishing field installation parameters and inspection procedures to ensure proper application and performance of field-applied coatings. Included are methods for qualifying and controlling the quality of field-applied products, guidelines for proper application and inspection and repair techniques to ensure long-term performance.

1.2. These practices are applicable to field applied coating systems used to prevent external corrosion in immersion/buried service.

1.3. These practices are applicable to new construction, rehabilitation, re-coating and field repairs.

1.4. All applicable health, safety and environmental codes, rules and regulations shall be followed when using these practices including product and material safety data sheets.

Section 2. Terms and Definitions

For the purposes of this document, the following terms and definitions apply:

application procedure specification - APS
document describing procedures, methods, equipment and tools used for coating application

applicator
company that undertakes the coating application in accordance with the provisions of this part of ISO 21809

batch
quantity of material produced in a continuous manufacturing operation using raw materials of the same source and grade

batch certificate
certificate of analysis issued by the manufacturer

bonding agent
material applied as a film to the primed metal surface in order to ensure adhesion of the subsequent protective coating

certificate of compliance
one of the types of inspection documents defined by ISO 10474, issued in accordance with the purchasing requirements

coating operative
individual undertaking coating activity on the work site, including surface preparation

cutback
length of pipe left uncoated at each end for joining purposes (e.g. welding)

end user
company that owns and/or operates the pipeline system

field joint area
⟨weld zone⟩ uncoated area that results when two pipe sections or a pipe section and a fitting with coating cutbacks are assembled, by welding, in the field

holiday
coating discontinuity that exhibits electrical conductivity when exposed to a specific voltage

inspection and testing plan - ITP
document providing an overview of the sequence of inspections and tests, including resources and procedures

inspector
end user and/or purchaser's representative responsible for one or more of the inspections specified in this document

manufacturer
company responsible for the manufacture of coating material

maximum design temperature of field joint coating - T_{max}
maximum continuous temperature that the field joint coating can resist

maximum operating temperature
maximum temperature that can be reached during operation of pipeline

overlap
length of the field joint coating over the plant-applied coating including the coating bevel

pipeline
those facilities through which fluids are conveyed, including pipe, pig traps, components and appurtenances, up to and including the isolating valves

pipeline system
pipeline with compressor or pump stations, pressure control stations, flow control stations, metering, tankage, supervisory control and data acquisition system (SCADA), safety systems, corrosion protection systems, and any other equipment, facility or building used in the transportation of fluids

pre-production trial - PPT
application of coating and inspection/testing of its properties, to confirm that the APS is able to produce a field joint coating with the specified properties, carried out in the field immediately prior to start of production

primer
material applied as a film on substrate (metal and/or plant coating) to ensure adhesion of the subsequent protective coating

procedure qualification trial - PQT
application of a field joint coating and subsequent inspection/testing of its properties, to confirm that the APS is able to produce a coating with the specified properties, carried out at the premises of the applicator or any other agreed location

purchaser
company responsible for providing the product order requirements

wraparound sleeve
sleeve that is wrapped, circumferentially, around the steel pipe area being coated

Section 3. Coating Material Handling & Storage

3.1. The applicator shall ensure that the materials used for surface preparation and the coating(s) comply with the material specification and that the manufacturer's storage instructions are followed.

3.2. Powder shall be transported and stored in a sealed container that prevents the ingress of moisture or water.

3.3. Transportation and storage climate shall be controlled to meet the manufacturer's requirements and conformance shall be demonstrated by temperature-indication tags or other logging devices.

3.4. Contractor shall request special procedures to be prepared by the manufacturer for field storage.

3.5. Contractor shall load only enough materials to be used for each day's shift. Avoid exposing coating materials to adverse climate conditions like sun, rain, snow and humidity.

3.6. Unused material shall be inspected to ensure useful life. Follow manufacturer's recommendation to ensure shelf life is not exceeded.

3.7. Abrasive blast media shall be stored in a dry and controlled environment.

Section 4. Training and Qualification

4.1. The contractor shall provide a qualified coating foreman/crew by one of the following methods:

4.1.1. Pre-qualified coating foreman/crew members were previously trained by the coating supplier/applicator

4.1.2. The coating supplier provides a technician to train the contractor's coating foreman/crew at the job site. Company Representative should be involved in this training.

4.1.3. Coating foreman/crew members demonstrate on a production weld that they are trained and knowledgeable in the preparation of the pipe and the application of the specific coating being applied as agreed by end user. Recommend verification that the employees have been trained; i.e. card, hard hat sticker, letter, etc.

4.2. The contractor is responsible for maintaining trained personnel on the project through completion.

4.3. If Operator Qualification is required, assure that all covered tasks have been completed for the coating foreman/crew.

4.4. Company inspector shall be trained and knowledgeable in coating application procedures and in use of inspection instruments, have a complete set of inspection instruments and be able to demonstrate their use.

Section 5. Surface Preparation

5.1. Applicable worker health and safety regulations must be followed

5.2. Applicable environmental regulations must be followed to contain blast media and removed coatings. Effective containment also minimizes damage to nearby structures or property.

5.3. Abrasive blasting shall only be permitted under the following environmental conditions:

5.3.1. The temperature of the surface to be blasted or painted is more than 5°F (3°C) above the dew point temperature. Multiple surface temperature readings may be required for full-sun and shade readings.

5.3.2. The surface temperature and relative humidity is expected to remain reasonably stable for a sufficient time for the completion of abrasive blasting and applying coating.

5.3.3. The pipe and related components are dry.

5.3.4. Adverse conditions (e.g., fog, mist, rain, dust, or excessive wind) do not exist or are controlled.

5.4. Abrasive blast media shall conform to the following requirements:

5.4.1. Shall be supplied in original packaging from supplier/manufacturer

5.4.2. Conform to SSPC AB1, Abrasive Blasting Spec for Mineral and Slag Abrasives

5.4.3. Shall be suitable for achieving the required anchor profile

5.4.4. Blast media shall not be reused, unless utilize an automatic recovery system

5.4.5. If preheating is required due to ambient temperatures, this should be done prior to blasting, however in low ambient temperatures additional heating may be required after blasting while maintaining surface temperature 5°F (3°C) above the dew point.

5.5. Air compressors utilized for abrasive blasting and/or air cleaning shall meet the following requirements:

5.5.1. Shall provide moisture and oil free air as verified by a 30-second white rag test. Filters, separation, and/or dehydration equipment shall be utilized as required to meet this requirement.

5.5.2. Shall be capable of providing recommended pressure at abrasive blast nozzle (typically 90-110psi) as measured with a hypodermic needle gauge.

5.6. Abrasive blast nozzle orifices are within 25% of their rated sizes. Non-conformant nozzles shall be replaced.

5.7. The weld zone and surfaces including bare and specified overlap to be coated shall be inspected and 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.

5.8. All weld spatter, rough welds, burrs, and sharp steel surfaces shall be ground smooth using an approved grinding method or filing techniques prior to blasting. Grinding or filing shall not reduce the wall thickness below the specified minimum wall thickness of the pipe

5.9. Blasted surfaces shall be inspected using replica tape or equivalent to verify that the specified anch*or profile* h*as bee*n achieved. A minimum of two inspections per shift is required dependent upon applicators performance.

5.10. Blasted surfaces shall be verified to meet all agreed upon visual standards or equivalent.

5.11. Special attention shall be given to areas where local geometry complicates proper blasting (e.g., welds, corners, and lap joints). Special attention shall also be given to tight quarters and locations that are difficult to access.

5.12. All bare surfaces to be coated shall be dry abrasive blast cleaned to "Near-White" metal in accordance with NACE #2/SSPC-SP10 (latest version) per SSPC-Vis 1. The anchor pattern profile shall be a minimum of 2.0 mils to a maximum of 4.5 mils. Variation in required anchor pattern profile may be altered based on manufacturer's recommendations with Company approval. Adjacent areas of sound/existing coating shall be feathered in a 1 inch (2.54 cm) minimum radius around the exposed metal or blast area. This process should remove approximately 1 mil of coating. Cleaned surface shall be dry air blasted to remove dust and debris, and shall be coated within 4 hours of blast cleaning. All blast-cleaned surfaces that are not coated before flash rusting occurs shall be re-blasted prior to coating.

5.13. All spent abrasive shall be disposed of in accordance with applicable regulation.

Section 6. Field Application

6.1. Liquid Coatings

6.1.1. Coating Identification. The liquid coating (epoxy, polyurethane or other) shall meet the requirements outlined by the customer.

6.1.2. Coating Application

6.1.2.1. The coating shall be applied following the manufacturers recommended guidelines and procedures. There are several application methods currently being used today. Spray application via plural component unit is typically employed when the scale of the project warrants its use. Use of this equipment is determined by the applicator. Hand application is also an acceptable means of applying liquid coatings today. Methods of application include roller, brush squeegee and in some applications glove/mitt. Regardless of the application method, always follow the manufacturer's recommended guidelines and procedures.

6.1.2.2. If mixing is required, ensure it is carried out in accordance with manufacturer's recommendation. Only mix full packages of parts A and B.

6.1.2.3. The coating thickness shall be as specified by the coating manufacturer or the coating specification provided by the pipeline owner.

6.1.2.4. The steel surface temperature shall be at least 5°F (3°C) higher than the dew point temperature. The relative humidity and the steel surface temperature shall not be higher than the recommended maximum. The contractor shall use industry accepted equipment to monitor these environmental requirements.

6.1.2.5. Application shall be done in such a manner so as to minimize sags and runs, provide adequate coverage in angles and crevices, and to provide a reasonably uniform coating.

6.1.2.6. If several coats are required to achieve the specified coating thickness, follow the coating manufacturer's application recommendations for recoat times and procedures.

6.1.2.7. The coating shall be allowed to cure per the coating manufacturers recommendations prior to back filling, installation or handling.

6.2. Fusion-bonded epoxy (FBE) powder coatings

6.2.1. Coating identification. The epoxy powder for a single-layer coating and for the base layer of a two-layer coating shall meet the requirements outlined by the customer.

6.2.2. Application of the coatings: General

6.2.2.1. Prior to application, the powder shall be allowed to acclimate for a period of at least 30 minutes or until the powder is at the ambient air temperature prior to opening the sealed bag. Failure to do this could result in the material absorbing water from the air.

6.2.2.2. Application of the coating shall be carried out in accordance with the material manufacturers application guide and current industry recognized standards.

6.2.2.3. When over-coating existing coating material such as fusion bond epoxy (FBE) in such applications as field joint or abrasion resistant overcoat work, the existing coating shall be sweep blasted to remove the gloss and provide a roughened surface suitable for over-coating. This process should remove approximately 1 mil of coating.

6.2.2.4. Existing coating shall be feathered to a minimum of 1 inch (2.54 cm) when coating adjacent bare steel, such as rehabilitation or girth weld work.

6.2.2.5. Prior to blasting the temperature of the field joint should be made as uniform as possible either by shielding the area from the sun or pre-heating. The more uniform starting temperature of a field joint can optimize the uniformity of the joint temperature when heated to coating application temperature.

6.2.3. Heating

CAUTION – For pipe grades over X80 the excessive heat can affect the pipe properties.

6.2.3.1. The field joint area should be uniformly preheated, using a calibrated induction-heating coil to +/- 15 deg F, to a temperature as recommended by the powder manufacturer. If a Pre-Qualification Trial is performed, the rate and uniformity of the heat pattern shall be verified and documented. The typical coating range for FBE is between 425°F and 488°F (218°C and 253°C).

6.2.3.2. The temperature of the field joint shall be monitored using temperature-indicating non-oily crayons or other temperature measuring device (e.g. hand held, direct reading thermocouple or contact thermometer) to ensure that the application conditions are fully satisfied and the temperature is uniform across the steel substrate and the plant applied coating. The methods of monitoring and recording shall be specified by the customer. The pipe temperature shall be monitored for both the target coating temperature, typically 463°F (239 °C), and a maximum allowed coating temperature, typically 488°F (253°C). The amount of crayon used shall be the minimum required for accurate measurement. Any residue left from a temperature indicating crayon shall not be brushed off as brushing of the melted mark only serves to distribute it over a larger surface area.

6.2.3.3. The maximum pipe temperature shall not exceed 527°F (275°C) or temperature specified by Company

6.2.3.4. The heating time and the temperature shall not:

- result in oxidation, “blueing” of the surface of the steel detrimental to the quality of the field joint coating.
- damage the plant applied coating. With some coatings it should be remembered that re-heating will cause the coating to darken or take on a yellow or brown tinge.

6.2.3.5. If a delay results in surface cooling to below the temperature range specified by the powder manufacturer, the pipe shall be reheated, and if required the abrasive blasting shall be repeated to meet specification requirements.

6.2.4. Application of epoxy powder

6.2.4.1. The FBE shall be applied immediately after the substrate has attained the correct temperature. The field joint shall not be allowed to cool below the minimum application temperature before coating is applied. If the pipe does excessively cool it shall be re-blasted and re-heated.

6.2.4.2. Equipment Preparation

6.2.4.2.1. Ensure that equipment and hoses are free of powder build-up and contaminants as this has potential to dislodge during application and generate defects on the coating.

6.2.4.2.2. All powder application equipment and hoses shall be cleaned daily.

6.2.4.2.3. At the start of the shift and after any break the coating ring needs to be checked to ensure that the powder is uniformly flowing out of all applicators.

6.2.4.3. The FBE overlap onto the plant applied coating should be a minimum of 1 inch (2.54 cm).

6.2.4.4. The FBE powder should be uniformly applied, by means of a semi-automatic powder ring or carriage which is fitted to and rotates around the pipe to cover the blast cleaned and pre-heated surface, to provide the specified minimum dry film thickness (DFT). Alternative methods may be used with the approval of the end user.

6.2.4.5. The coating shall be allowed to cure for the time recommended by the coating manufacturer prior to any movement or inspection taking place.

6.2.4.6. Cured field applied FBE shall not be over-coated with another layer of FBE.

Section 7. Inspection Procedures

7.1. Abrasive blast cleaning operations shall not be conducted on surfaces that are less than 5°F (3°C) above dew point. If the surface temperature is less than 5°F (3°C) above the dew point with Company approval, the exposed bare surfaces shall be pre-heated to 150°F (66°C). The surface temperature shall be monitored with temperature-indicating sticks such as Tempilstik, or with digital thermometers.

7.2. Anchor pattern profile shall be measured with either replica tape such as Press-O-Tape or digital surface profile gauges and the measurement results documented. The profile shall be in accordance with Section 4.14. The frequency of required documentation shall be site or project-specific and approved by Company personnel.

7.3. Dry film thickness on liquid and cured FBE shall be measured by an approved mil gauge calibrated twice per shift.

7.3.1. All mud, moisture, or other contamination on the coating shall be removed before jeeping.

7.3.2. Holiday detectors shall be calibrated according to manufacturer's specifications at a minimum of twice per day normally at the beginning of the day and approximately 1/2 way through the shift. The test voltage should be verified during calibration.

7.3.3. Jeeping or holiday detection shall be performed at each coating area. Detection voltage should be based on specified nominal pipe coating thickness and calculated in accordance with NACE Holiday Detection Standard, SP 0490, but other detection voltages may be set by the Company. Pulse jeep detectors are also acceptable.

7.4. The detector shall readily detect and indicate a holiday (natural or artificial [for calibration]) both audibly and visually. Under no circumstances shall brass brushes or angel hair be used for jeeping. The electrode shall be kept free of coating material and in suitable mechanical condition to maintain contact with the coated surface at all times.

Section 8. Remediation and Re-Inspection

8.1. The acceptable size and frequency of field joint coating repairs and the repair procedures shall be subject to agreement between the purchaser and the applicator. The repair procedures shall be included in the Company's specification.

8.2. Holidays and damaged areas in the FBE coating shall be repaired using two-part epoxy or polyurethane repair materials in accordance with the manufacturer's recommended practice and the Company's specification. Due to difficulty in proper application, use of melt sticks is not recommended.

8.3. Holidays shall be cleaned by removing all rust, scale, dirt, other foreign material, and loose coating.

8.4. The repair areas, both the holiday and the adjacent coating, shall be suitably roughened in accordance with the repair materials manufacturer's recommendations. Dust shall be removed with a clean, dry cloth, brush or air.

8.5. All repairs shall have a minimum dry film thickness at least equal to the minimum specified coating thickness for the parent coating. The overlap of the repair coating onto the parent coating shall be a minimum of 1 inch (2.54 cm).

8.6. All repairs shall be holiday tested as described in Section 6.

Appendix A. Referenced Standards

ISO–International Organization for Standardization

ISO 8501-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates and of Steel Substrates After Overall Removal of Previous Coatings
ISO 8501-2	Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness. Preparation grades of previously coated steel substrates after localized removal of previous coatings
ISO 8501-3	Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 3: Preparation Grades of Welds, Edges and Other Areas With Surface Imperfections
ISO 8502 - 1	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8502-3	Preparation of Steel Substrates Before Application of Paint and Related Products - Tests for the Assessment of Surface Cleanliness - Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method)
ISO 8502 - 4	Preparation of Steel Substrates Before Application of Paints and Related Products - Tests for the Assessment of Surface Cleanliness - Part 4: Guidance on the Estimation of the Probability of Condensation Prior to Paint Application
ISO 8502-6	Preparation of Steel Substrates Before Application of Paints and Related Products - Tests for the Assessment of Surface Cleanliness - Part 6: Extraction of Soluble Contaminants for Analysis - the Bresle Method
ISO 8502-9	Preparation of Steel Substrates Before Application of Paints and Related Products - Tests for the Assessment of Surface Cleanliness - Part 9: Field Method for the Conductometric Determination of Water-Soluble Salts
ISO 8503-1	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates Part 1: Specifications and Definitions for ISO Surface Profile Comparators for the Assessment of Abrasive Blast-Cleaned Surfaces
ISO 8503-2	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast - Cleaned Steel Substrates Part 2: Method for the Grading of Surface Profile of Abrasive Blast-Cleaned Steel - Comparator Procedure
ISO 8503-3	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast -Cleaned Steel Substrates Part 3: Method for the Calibration of ISO Surface Profile Comparators and for the Determination of Surface Profile - Focusing Microscope Procedure

ISO 8503-4	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates - Part 4: Method for the Calibration of ISO Surface Profile Comparators and for the Determination of Surface Profile - Stylus Instrument Procedure
ISO 8503-5	Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates - Part 5: Replica Tape Method for the Determination of the Surface Profile

NACE–National Association of Corrosion Engineers

NACE RP0105	Standard Recommended Practice Liquid-Epoxy Coatings for External Repair, Rehabilitation, and Weld Joints on Buried Steel Pipelines
NACE RP0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
NACE RP0394	Application, Performance, and Quality Control of Plant-Applied, Fusion-Bonded Epoxy External Pipe Coating
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates
NACE RP0402	Field-Applied Fusion-Bonded Epoxy (FBE) Pipe Coating Systems for Girth Weld Joints: Application, Performance, and Quality Control
NACE RP0490	Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760 Micrometers (10 to 30 Mils) Item No. 21045

SSPC–The Society for Protective Coatings

SSPC AB 1	Mineral and Slag Abrasives
SSPC AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
SSPC GUIDE 15	Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
SSPC PA 2	Measurement of Dry Coating Thickness with Magnetic Gages
SSPC SP 1	Solvent Cleaning
SSPC SP 2	Hand Tool Cleaning
SSPC SP 3	Power Tool Cleaning
SSPC SP 10	Near-White Metal Blast Cleaning (NACE NO. 2)
SSPC SP 11	Power Tool Cleaning to Bare Metal

ASTM–American Society for Testing and Materials

ASTM D 4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D 4940	Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blasting Abrasives
ASTM D 5162	Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
ASTM D 6677	Standard Test Method for Evaluating Adhesion by Knife

Appendix B. Sample Forms for Reporting, Data Management & Certification
Procedure Qualification and Quality Control Report

Coating Procedure Qualification/Quality Control Test Report						
Applicator Team Leader Name:					Report No.:	
QC Responsible Name:					Date:	
Test Piece No.:		Test Piece Diameter [mm]			Page:	
Product Data						
Coating		Batch/Lot #, Pt A		Batch/Lot #, Pt B		Batch Size
Preheating						
Method		Initial Substrate Temperature, °C		Final Preheat Temperature, °C		Remarks
Environment Data						
No.	Location	Ambient Temperature °C	Substrate Temperature °C	Humidity %	Dew Point °C	Remarks
Post-Curing						
Method		Post-Heat Temperature		Duration, minutes		Remarks
Test Data for Coating						
Controlling Document #						
Test Results						
No.	Test	Criteria		Test Results		Remarks
1	Abrasive	Conformance with SSPC AB 1 or SSPC AB 3				
2	Compressed Air Quality	No visible contamination per ASTM D 4285				
3	Pre-coating Visual Check	Visual per ISO 8501-1 and ISO 8501-3				
4	Salt Contamination Test	Less than 20 mg/m² ($1.4x10^{-3}$ grains/ft^2) equivalent NaCl ISO 8502-6 or ISO 8502-9 or SSPC GUIDE 15				
5	Blast Cleaning Surface Profile	SA2.5 ISO 8503-4 or ISO 8503-5				
6	Blast Cleaning Degree of Cleanliness	SA2.5, NACE RP0394				
7	Application Temperature [°C]	Within Manufacturer's stated criteria				

8	Coating Application Surface Visual Check	No popping, sagging, pinholes, or contamination. Defect density no greater than one defect or cluster per 1 m^2 (12 ft^2).		
9	Coating Application Thickness	0.6 to 1.25 mm (24-49 mils) per SSPC PA 2		
10	Holiday Detection Test	Per NACE SP0188, no holidays on test piece.		
11	Impact Test	Per ASTM G 14, 3.5 J (13 in.-lb) minimum		
12	Water Soak/Adhesion Test	Rating 1 to 3 per NACE RP0394, or 6 to 10 per ASTM D 6677		
13	Penetration Resistance	< 10% of DFT per ASTM G 17		
14	Cathodic Disbondment (CD) Test	Per NACE RP0394, 24-hour, < 6.0 mm (0.25 in.) radius		
15	CD Test No. 2			
16	CD Test No. 3			
17	Repair Procedure - visual	No visible defects.		
18	Repair Procedure – Holiday Detection	No holiday in or at edge of repair.		

Notes:

Result of the Procedure Qualification Test	We certify that the statements in this record are correct and that the application was done in accordance with the relevant procedure.
□ Qualified □ Not Qualified	

	APPLICATOR	CONTRACTOR
Name		
Signature		
Date		

APPROVALS

	COMPANY	OWNER
Name		
Signature		
Date		

Applicator Qualification Report

Coating Applicator Qualification Test Report						
Applicator Team Leader Name:					Report No.:	
QC Responsible Name:					Date:	
Test Piece No.:		Test Piece Diameter [mm]			Page:	
Product Data						
Coating		Batch/Lot No., Pt A		Batch/Lot No., Pt B	Batch Size	
Environment Data						
No.	Location	Ambient Temperature °C	Substrate Temperature °C	Humidity%	Dew Point °C	Remarks
Applicator Qualification Test						
Name of Applicator		Date of Birth		Place of Birth	Qualifications	
Test Results						
No.	Test	Criteria		Results	Remarks	
1	Coating Application Surface Visual Check	No popping, sagging, pinholes, or contamination. Defect density no greater than one defect or cluster per 1 m^2 (12 ft^2).				
2	Coating Application Thickness	0.6 to 1.25 mm (24–49 mils) per SSPC PA 2				
3	Holiday Detection Test	Per NACE SP0188, no holidays on test piece				
11	Impact Test	Per ASTM G 14, 3.5 J (13 in.-lb) minimum				
12	Water Soak/Adhesion Test*	Rating 1 to 3 per NACE RP0394				
13	Penetration Resistance*	< 10% of DFT per ASTM G 17				
14	Cathodic Disbondment (CD) Test*	Per NACE RP0394, 24-hour, < 6.0 mm (0.25 in.) radius				
15	CD Test No. 2*					
16	CD Test No. 3*					
4	Repair Procedure – visual	No visible defects				
5	Repair Procedure – Holiday Detection	No holiday in or at edge of repair				
* Tests to be performed only during PQT activities						

Notes		
Result of the Applicator Qualification Test □ Qualified □ Not Qualified		We certify that the statements in this record are correct and that the application was done in accordance with the relevant procedure
	APPLICATOR	CONTRACTOR
Name		
Signature		
Date		
APPROVALS		
	COMPANY	OWNER
Name		
Signature		
Date		

Coating Application and Inspection Report

Coating Inspection Report					
Applicator Team Leader Name:				Report No.:	
QC Responsible Name:				Date:	
				Page:	
Product Data					
No.	Coating	Batch/Lot No., Pt A	Batch/Lot No., Pt A	Batch Size	
Abrasive Blast Media					
No.	Media Type/Brand	Lot Nos.	Length/No. sections	Remarks	

Environmental Data						
No.	Time	Ambient Temperature °C	Substrate Temperature °C	Humidity%	Dew Point °C	Remarks
1						
2						

Notes:

Coating Inspection																
Identification		Pre-coating inspection			Pre-heating	Blast Cleaning Visual Checks			Coating Application			Post-curing		Holiday Test	Adhesion	Notes
No.	Joint or bend No.	Visual Check (OK?)	Salt Cont. (reading)	Oil/ Grease check/ clean (OK?)	Pre-heat temperature °C	Compressed Air Quality (OK?)	Surface Profile (mils)	Surface Cleanliness (Sa or SSPC designation)	Temperature °C	Visual Check (OK?)	Thickness Check (avg.)	Temperature °C	Time at Temperature (min)	(No. holidays)	Test (rating)	
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
Notes																

	APPLICATOR	CONTRACTOR	COMPANY
Name			
Signature			
Date			

Coating Repair Report

Coating Repair Report												
Applicator Team Leader Name:										Report No.:		
QC Responsible Name:										Date:		
										Page:		
Environment Data												
No.		Time	Ambient Temperature °C		Substrate Temperature °C			Humidity %		Dew Point °C		Remarks
1												
2												
Coating Repaired												
		Coating	Location of the Defect		Type of Repair (Application Method)			Coating Repair Check		Post-Curing		Notes
No.	Pipe/ Joint Number	Product Name	Length	Position	Brush	Roller	Spray	Visual Check (OK?)	Holiday Test (OK)	Temp (°C)	Time (min)	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
Notes:												

	APPLICATOR	CONTRACTOR	COMPANY
Name			
Signature			
Date			

Appendix C. Coating Training Guidance from Team 5,
Training Guidance (KISS) for Construction Workers and Inspectors – Welding & Coating

QUALITY CONTROL FIELD INSPECTION AND TEST PLAN

Weld Joint Coating Procedure

Page 1 **Rev. 0**

Item No.	Activity	Project Procedure	Frequency	Acceptance Criteria	Contractor Responsibility	Operator Responsibility	Action/Record
1	Safety "JSA" Prior to performing ANY duties the coating foreman must ID ALL Hazards	**Safety Manual**	Daily	Ensure ALL employees are wearing proper PPE for the relevant task at hand	Coating Foreman		• Tailgate safety • Appropriate P.P.E • Complete & sign JSA • Blasting Hood/Fresh Air Canister/Air Lines • Gloves • CO2 monitor • Excavation safety review
2	Applicator qualifications	Manufacturers Specifications	Per Project	• Understanding of manufacturing installation techniques • Verification of Operator Qualification as applicable	Coating Foreman		• Demonstrates knowledge of manufacturing installation methods / techniques • Field Verification report or equivalent
3	Inspection & Surface prep, (blasting)	Weld Joint	2 per shift	• Test Pipe to see if non-visible contaminates exist. Clean as per Operator specification. • Blasted to a "NEAR WHITE" finish per NACE #2 or SSPC-SP 10 • Surface Profile will be checked and documented per NACE	Coating Foreman	Coating / Utility Inspector	• Inspect & Examine pipe for non-visible contaminates. • Blast and check profile • Remove all Frayed/Loose coating near cutback • Brush Blast existing FBE • Daily coating foreman report.

				RP0287-2002 as applicable			
4	Coating Application	Weld Joint	2 per shift	• As per application specification. Pipe temperature has to be 5 degrees above dew point. • Pre-heat pipe as per specification	Coating Foreman	Coating / Utility Inspector	• Document temperatures • Do not handle, lower in, or backfill until completely cured • Measure dew point temperature and pipe temperature • Daily coating foreman report
5	Pipe Coating Inspection	Weld Joint	Each joint	• No damage • All coated pipe shall be tested at a minimum of three times: to locate holidays, after the holidays are patched, and just before pipe is lowered into the ditch. • Check for appropriate coating thickness. • Utilize holiday detector with voltage setting as specified in NACE SP 0490. • In addition the holiday detectors batteries shall be checked every 4 hours and replaced/recharged if required. • Calibrate holiday detector daily • All holiday detection and holiday repairs shall be conducted to the satisfaction of the Coating Inspector.	Coating Foreman	Coating / Utility Inspector	• Visual Inspect • Jeep • No record

6	Coating repair	Weld Joint	As needed	Repair with two part epoxy in accordance with Operator specifications.	Coating Foreman	Coating / Utility Inspector	• No Record
7	Storage & Handling		Daily	Maintained and stored in accordance with manufacturing specifications.	Coating Foreman		• Ensure proper Storage