

Construction & Pipeline Coatings

Corrosion Found Less than One Year of Service



Coating reflects Quality

- Inspection and repair of coating on a new pipeline reflects the **Quality** of the contractors workforces and training.
- The job is not difficult, nor glamorous, but requires knowledge, skill, and will to pay attention mile after mile, looking for large and many small defects.

Preface

- Operators are responsible for construction to be in compliance with Code of Federal Regulations Part 192 or 195 and to follow the operator's procedures.
 - Not the contractor
 - Not the inspection service

Written Construction Procedures

Gas & Liquid

Gas

- § 192.605(a) Each operator shall prepare and follow ...a manual of written procedures for;
(2) Controlling corrosion in accordance with the...requirements of **subpart I**
- Coating Procedures need to List Approved Coating Materials (Manufacturer & Product #)
- Operator should be able to justify requirements of § 192.461(a)(1-5) and (b)

Liquid

- §195.402(a) Each operator shall prepare and follow ...a manual of written procedures for;
(c)(3) Operating, maintaining, and repairing the pipeline system in accordance with each of the requirements of this subpart and **subpart H** of this part
- Coating Procedures need to List Approved Coating Materials (Manufacturer & Product #)
- Operator should be able to justify requirements of § 195.559 (a) – (f)

Written Construction Procedures Gas & Liquid

- The operator's procedures are to be made known to all the personnel responsible for those various tasks.
 - **Beneficial:** Conduct a training session for those individuals on these specific procedures.
- Operator Qualifications required for O&M construction and new 80% SMYS permit construction.

Gas Regulations Even Specify What Is Intuitive

- § 192.461 External corrosion control: Protective coating
 - (a) Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must—
 - (1) Be applied on a properly prepared surface;

Surface Preparation

- Purpose of Surface Preparation
 - Clean Metal Surface
 - Abrade Metal Surface
 - Surface/Anchor Profile

Surface Preparation

Coating Manufacturer will specify the type of surface preparation required

Industry Standards

- Steel Structures Painting Council (SSPC)
- NACE International

Surface Preparation

- SSPC-SP 1 Solvent Cleaning
 - Removes Grease/Oil and Debris
- SSPC-SP 2 Hand Tool Cleaning
 - Removes loose mill scale, rust, paint, and other detrimental foreign material with hand tools
- SSPC-SP 3 Power Tool Cleaning
 - Removes loose mill scale, rust, paint, and other detrimental foreign material with power tools,
 - Examples: white metal blast, near white metal and commercial blast cleaning
 - Near white - Typical Surface Prep. for Epoxies

Coating Procedures

- Surface Preparation Requirements
 - Specify by Industry Standards (SSPC & NACE)
- Application Method
 - Spray, Brush or Roller?
- Application Conditions
 - Air & Surface Temperature
 - Caution use Infrared Temperature Guns that are calibrated to surface
 - Relative Humidity & Dew Point (Epoxies & Urethanes)

Coating Procedures

- Thickness Requirements
 - Dry Fill Thickness (mils) per Coat for Liquid/Powder Coatings
- Overlap Requirements
 - Tape Coating & Shrink Sleeves
 - Minimum Overlap of Consecutive Wraps
 - Minimum Overlap of Existing Coatings
- Cure Time prior to Recoating or Burying

Product Description

3M Scotchkote™ Hot Melt Patch Compounds, (H.M.P.C.) are heat bondable polymeric coatings in stick form designed for plant and field repair of Scotchkote Fusion Bonded Epoxy Coatings.

Scotchkote Hot Melt Patch Compounds are ideal for repairing minor pinholes and abrasions. Scotchkote 226P H.M.P.C. is colormatched to Scotchkote 226N and 6233.

Scotchkote 226P H.M.P.C. can be used on holidays where no steel is visible. The following 3M two-part epoxies should be used for bare steel areas larger than pinholes, depending on the functional and application properties required:

Scotchkote 323 Scotchkote 323i

Scotchkote 352 Scotchkote 327

Features

- Easy to apply
- Usable in all weather conditions

General Application Steps

1. Roughen the surface of the parent FBE coating using 80-mesh to 120-mesh sandpaper. Clean the surface and wipe away the sanding residue with a non-contaminating cloth.
2. Preheat the parent-coating surface using a non-contaminating heat source, such as portable hand-held butane torch. Heat should be applied in a manner that avoids burning or charring of the epoxy coating. Slight browning of the parent coating is acceptable, but charring or blistering is not. Avoid heat application directly to the patchstick while prewarming the coating surface.
3. While continuing to heat the FBE surface, occasionally draw the patchstick across the repair area until it leaves a residue. Then rub the stick in a circular motion and utilize the torch to help melt it and maintain the pipecoating temperature. Continue until the patch is smooth and has a thickness of at least 15 mils (380 microns) greater than the parent coating.
4. Allow the patch to cool before handling.

Poor Patch Stick Application Lack of Adhesion



Excessively Large Patch Stick Application Use for Pinholes Only on 42" Pipe



Inappropriate Bundling of Patch Sticks Use One Only-Small Areas



Coating Inspection

- Visual
 - Runs, Drips, Blisters, Foreign Inclusions
 - Wrinkles and Insufficient Overlap in Tape & Shrink Sleeves
- Thickness Measurement
 - Critical for Liquid Applied Coatings
- Holiday Testing (jeeping)
 - Electrical Test for Small Defects

Holiday Detection (Jeeping)

- **Holiday:** A discontinuity in a protective coating that exposes unprotected surface to the environment.*
- **Holiday detector:** A device for locating discontinuities in a coating.*

(*NACE SP0490-2007)

Voltage Settings for Holiday Detectors

- Operators O&M Manual: §192.605 (a)(2)
§195.402(a)
 - **Requirements should be in Operators Written Procedures or Project Specifications**
- NACE RP0274-2004: High-Voltage Electrical Inspection of Pipeline Coatings
- NACE SP0490-2007: Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings Coating
- Manufacturer's Published Instructions

Recommended Testing Voltages (non-FBE)

(*NACE RP0274-2004)

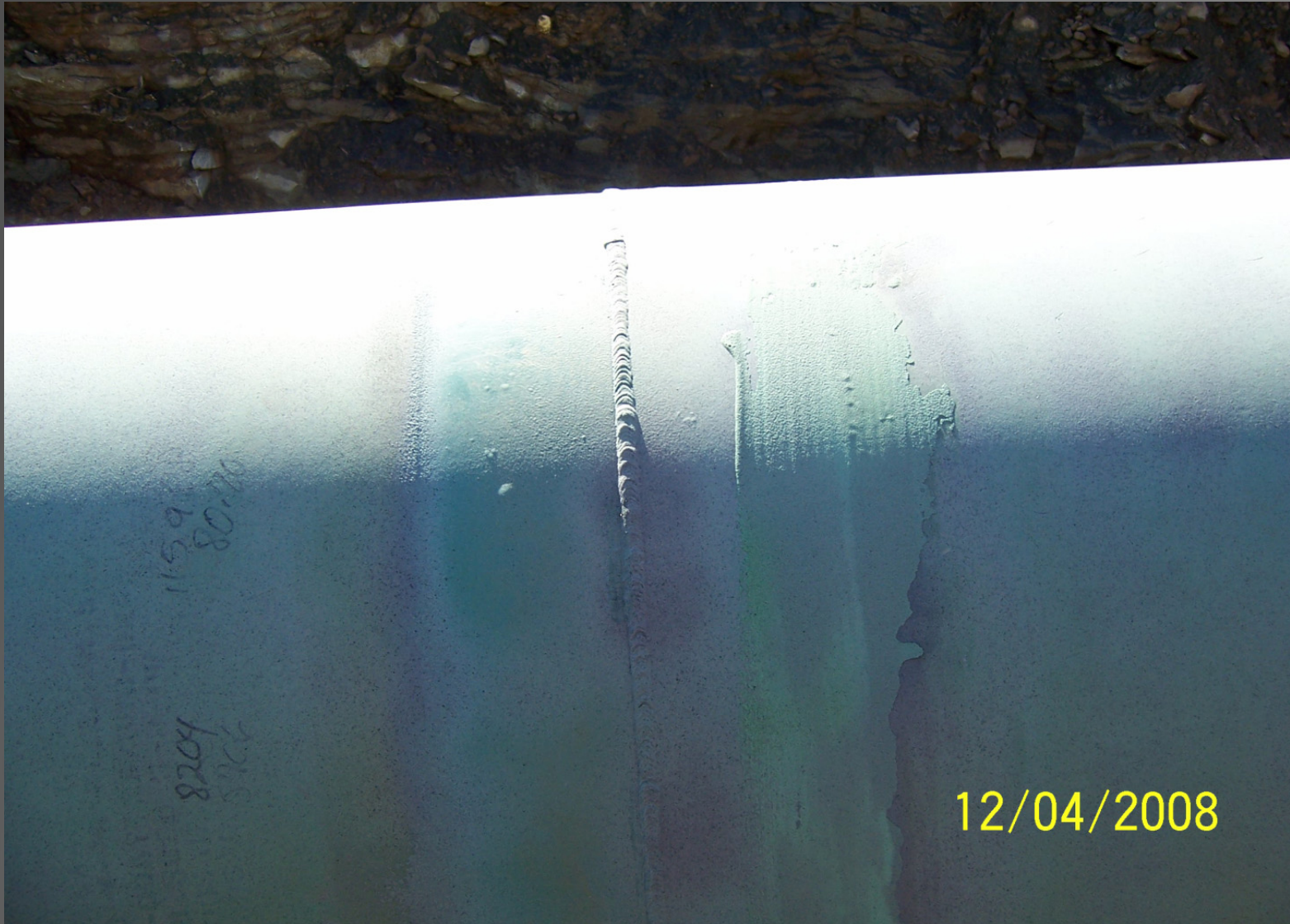
Coating Thicknesses		Testing Voltage
(mm)	(mils)	(volts)
0.51	20	6,000
0.79	31	7,000
1.6	62	10,000
2.4	94	12,000
3.2	125	14,000
4.0	156	16,000
4.8	188	17,000
13	500	28,000
16	625	31,000
19	750	34,000

Recommended Testing Voltages for FBE

(*NACE SP0490-2007)

Coating Thickness	Test Voltage
(mils)	(volts)
10	1,650
11	1,750
12	1,800
13	1,900
14	1,950
15	2,050
16	2,100
20	2,350
25	2,650
30	2,900

Thin Field Joint Coating



Joint Coating Applied over Dirt/Debris



Coating Damage Cause by Welding Band (Jeep did not indicate holiday)



Tape on Pipe Preventing proper Holiday Detection



Lowering

Sidebooms Spaced Per API 1104, Appendix A,
ECA Stress Analysis



Bored Crossing – Failed Hydro Test



Rocks against pipe (No screening for over 1 mile)



Pipe laid directly on solid rock



PHMSA New Construction Coating Issues

- Failing to visually inspect pipe
- Electronic Holiday Detection (Jeeps)
 - Failing to follow written instructions
 - Low voltage setting
 - Using bent defective springs
 - High resistance in electrical circuit (grounding)
 - Jeeping over duct tape and fiberboard
 - Jeeping only at skid locations upon lowering-in
 - Traveling too fast and with Holiday Detector not working

PHMSA New Construction Coating Issues

- Two Part Epoxy
 - Failing to follow Written instructions
 - Failing to properly prepare surface and use solvent wipe (some manufacturers require solvent wipe)
 - Applying coating repair after epoxy starts to set (pot life)
 - Applying coating below or above manufactures recommended temperature or not heating pipe before application

PHMSA New Construction Coating Issues

- Fusion Bond Epoxy issues
 - Failing to follow written instructions
 - Improper application temperature
 - Heating pipe containing water (water prevents obtaining proper temperature)
 - Coating over mud or rust
 - Poor preparation during sand blasting (no sweeping over factory coating)

PHMSA New Construction Coating Issues

- **FBE Patch Stick Issues:**
 - Failing to follow written instructions
 - Not heating pipe during application
 - Using the patch stick on bare metal - for pinhole or abrasion repair only
 - Failing to prepare surface by sanding as required by manufacturer
 - Repairing two part epoxy with patch stick

PHMSA New Construction Excavation Issues

- Insufficient burial depth
- No One Call Notifications
- Inadequate use of rock shield, padding machines, or selective backfill
- Dents caused by placing pipe on rocks
- Construction crews damaging pipe and coating during installation in ditch and backfill and when installing river weights

Construction Damage

Section of Pipe was Replaced

(found by DCVG Survey-Line was in Service)



Gouge in Pipe

(found by DCVG Survey-Line was in Service)

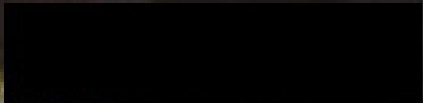








**Right in the
area to be
joined...**





Case study:

The Operator did not mark the proper stab depth before performing an electrofusion.



Another example of not marking the proper stab depth before performing an electrofusion.



§192.325(b) - Failure to install a main with enough clearance from any other underground structure to allow for proper maintenance



Electric Line

Sewer Line



2" Plastic Gas Main



What Not to Do with Equipment



























8/7/1999



















10/25/2002 11:08am

