



U.S. Department  
of Transportation

**Pipeline and  
Hazardous Materials  
Safety Administration**

# **Construction & Pipeline Coatings**



U.S. Department  
of Transportation

Pipeline and  
Hazardous Materials  
Safety Adminis

# 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



U.S. Department  
of Transportation

Pipeline and  
Hazardous Materials  
Safety Administration

# 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)

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

# Thin Field Joint Coating



# Joint Coating Applied over Dirt/Debris







U.S. Department  
of Transportation  
Pipeline and  
Hazardous Materials  
Safety Administration

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







U.S. Department  
of Transportation

Pipeline and  
Hazardous Materials  
Safety Administration

# Tape on Pipe

## Preventing proper Holiday Detection





U.S. Department  
of Transportation  
Pipeline and  
Hazardous Materials  
Safety Administration

# 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)

