Northeast Gas Association
Gas Operations School
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Corrosion Control Coatings
Field Applied Liquids

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Types of Liquid Coatings

- Liquid Epoxies
- Mastics
- Paints
Liquid Epoxies

- **Liquid Epoxies**
  - 2-part Liquid Coating Systems
  - Used in New Construction or Pipeline Rehabilitation
  - Applied to Girth Welds, Pipelines, Fittings or Valves

- **Time & Temperature Dependent**
  - High Build, Fast Cure (40 F – 185 F)
  - Low Temperature (–4F – 40F)
  - High Temperature (185F – 250F)
  - Wet Applied Epoxies for Damp or Sweating Substrates
Liquid Epoxies

- **HDD Liquid Epoxies**
  - ARO (Abrasion Resistance – Only) – Applied over the top of FBE or Corrosion Coating
  - Combination – Corrosion Control & Abrasion Resistance coatings – All-in-One

- **Surface Tolerant Epoxies**
  - Used when Substrate can NOT be blast cleaned
Begin with the End in Mind....

“Good training uses scenarios relevant to what we do.”

Donald Doubleday
Network Strategy
Keys to a Successful Application:

- Proper Surface Preparation
- Understanding Temperatures & Cure rates
- Use of Proper Equipment
- Trained Applicators
- Quality Control / Quality Assurance
Consider Installation Conditions...

- Surface Prep
  - Sandblasting
  - Tooling

- Cure Times
  - Permit Hours
  - Pipe Mobilization

- Weather Conditions

- Inspection
  - Jeeping
Marcellus Shale Projects:
# Liquid Epoxy Cure Times

<table>
<thead>
<tr>
<th>Substrate Temp</th>
<th>Tach Free Time</th>
<th>Backfill Time</th>
<th>Substrate Temp</th>
<th>Tach Free Time</th>
<th>Backfill Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 F</td>
<td>6-8 Hours</td>
<td>18-24 Hours</td>
<td>0 F</td>
<td>2 Hours</td>
<td>8 Hours</td>
</tr>
<tr>
<td>50 F</td>
<td>2-3 Hours</td>
<td>6-9 Hours</td>
<td>10 F</td>
<td>1.5 Hours</td>
<td>6 Hours</td>
</tr>
<tr>
<td>70 F</td>
<td>30 - 35 Minutes</td>
<td>1.5 – 2 Hours</td>
<td>20 F</td>
<td>1 Hour</td>
<td>4 Hours</td>
</tr>
<tr>
<td>80 F</td>
<td>20 - 30 Minutes</td>
<td>1 - 1.5 Hours</td>
<td>30 F</td>
<td>45 Minutes</td>
<td>3 Hours</td>
</tr>
<tr>
<td>90 F</td>
<td>15-20 Minutes</td>
<td>45-60 Minutes</td>
<td>40 F</td>
<td>35 Minutes</td>
<td>2 Hours</td>
</tr>
<tr>
<td>110 F</td>
<td>12-15 Minutes</td>
<td>30-45 Minutes</td>
<td>50 F</td>
<td>25 Minutes</td>
<td>1.5 Hours</td>
</tr>
<tr>
<td>130 F</td>
<td>9-12 Minutes</td>
<td>25-30 Minutes</td>
<td>60 F</td>
<td>15 minutes</td>
<td>1 Hour</td>
</tr>
<tr>
<td>170 F</td>
<td>5-7 Minutes</td>
<td>15-20 Minutes</td>
<td>70 F</td>
<td>10 Minutes</td>
<td>40 Minutes</td>
</tr>
</tbody>
</table>
Surface Preparation
Corrosion Protection starts from the surface of the pipe out. All substances that could interfere or prevent the coating from bonding to the substrate must be removed prior to the coating.

Remove:
- All loose Rust, Dirt and Dust
- Moisture, Grease, Oil, Mill Lacquer & Shop Coating
- Sharp Edges, Burrs, Weld Slag, Mill Scale

- **Pre-Heat:** (when applicable) substrate to Mfg’s specifications
- **Blast Clean:** to NACE 2/SSPC–SP 10 standards

Refer: to Manufacturers Installation Guides to determine the appropriate surface preparation procedures for the coating you are using.

Without PROPER surface preparation the coating will FAIL
# Surface Preparation Standards

<table>
<thead>
<tr>
<th>SSPC</th>
<th>NACE</th>
<th>Description</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td></td>
<td>Solvent Cleaning</td>
<td>Removal of oil, grease, dirt, soil and contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.</td>
</tr>
<tr>
<td>SP2</td>
<td></td>
<td>Hand Tool Cleaning</td>
<td>Removal of loose rust, loose mill scale and loose paint by hand chipping, scraping, sanding and wire brushing.</td>
</tr>
<tr>
<td>SP3</td>
<td></td>
<td>Power Tool Cleaning</td>
<td>Removal of loose rust, loose mill scale and loose paint by power tool chipping, descaling, sanding, wire brushing and grinding</td>
</tr>
<tr>
<td>SP10</td>
<td>2</td>
<td>Near White Blast Cleaning</td>
<td>Blast cleaning until at least 95% of each square inch is free of all visible rust, mill scale, paint and foreign matter.</td>
</tr>
</tbody>
</table>
# Surface Preparation Standards

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<th>SSPC</th>
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<tbody>
<tr>
<td>SP6</td>
<td>3</td>
<td>Commercial Blast Cleaning</td>
<td>Blast cleaning until at least two-thirds of each square inch is free of all visible residues.</td>
</tr>
<tr>
<td>SP 7</td>
<td>4</td>
<td>Brush Off Blast Cleaning</td>
<td>Blast cleaning of all except tightly adhered residues of mill scale, rust and coatings.</td>
</tr>
<tr>
<td>SP 8</td>
<td></td>
<td>Pickling</td>
<td>Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling.</td>
</tr>
<tr>
<td>SP5</td>
<td>1</td>
<td>White Metal Blast Cleaning</td>
<td>Removal of all visible rust, mill scale, paint and foreign matter by blast cleaning.</td>
</tr>
</tbody>
</table>
PREHEATING - Weld Joint & Adjacent Coatings

- Cold Weather Applications
  - Substrate < 40° F
  - Time & Temperature Dependent

- Relative Humidity <85%
  - Substrate Temperature 5°F above the Dew Point
  - Relative Humidity
  - Air Temperature
  - Substrate Temperature
  - Air / Steel Temp. Differential
  - Dew Point Temperature

- Dry Surface Area

- Achieve Faster Cure Times
Preheat Surface Prior to Sandblasting

- Examples of heat sources:
  - Infra-red heaters
  - Induction coils
  - Propane torches
Blast Clean

- NACE 2 / SSPC-SP2
- 2.0 – 4.0 mil Anchor Profile

- Common Abrasives:
  - Coal or Copper Slag, Garnet

- Some Common Trade Names:
  - Black Beauty
  - Green Diamond
  - Kleen Blast
  - Star Blast

- PLAY SAND IS NOT ACCEPTABLE
Surface Preparation – Blast Tools

“Little Bully” Blaster
Alternative Surface Prep Tools

Power tool cleaning with wire brush (SSPC SP3) **NOT ACCEPTABLE**

Use of MBX Bristle Blaster is acceptable, imparts 2 – 3 mil profile
Epoxy “Wet-Out”

Epoxy has **NOT** flowed into the Anchor and Surface cavities.

Epoxy **HAS** flowed into the Anchor and Surface profiles. The Adhesive has “Wet-Out”
Blast Clean Surface Preparation:

- Mainline coating must be cleaned and abraded.
- Knock shine off existing coating
- Don’t blast through existing coating.
SURFACE PREPARATION – ABRASIVE BLAST

- Quality Control
  - Near-White Metal (SSPC-SP10, NACE 2, Sa 2 ½) or better.
  - Blast profile should be 2–4 mils

Near-White Surface Prep
Testex Tape w/ micrometer
QUALITY CONTROL

Measuring Surface Profile
Application Procedures
Liquid Epoxy Application Procedures

- Check mil thickness with WET Film Gauge
- **Pot Life** 5–7 Minutes of Working Time
- Allow~ 60–90 min for **Tack Free** coating
- **Cure Time** ~ 4–6 hours before Handling & Backfill
- Recheck coating thickness prior to backfill with DRY Film Gauge and Holiday Inspector
Most two part epoxies are supplied in two separate containers:
- Large Container – Base
- Small Container – Cure

Containers will be color coded to prevent mixing different kit sizes
Mixing Two-Part Epoxies

- Empty all cure from container to ensure proper ratio is achieved.
- The use of a paint stick or rubber spatula can help you to remove all cure contents
- Mix Part A + Part B = a CONSISTANT Color
- No Marbling
Mixing Two-Part Epoxies

Mixing Choices:

- Hand
- Mechanical Mixer (Drill)
- Pneumatic Dispenser
- Plural Component Spray/Dispenser
MIXING 2-PART EPOXIES

Do Not Allow “Road-Side” Chemistry!

- Cure heavy – will react too quickly and become brittle once it has kicked over
- Cure light – may never react fully and will not protect the pipeline
- Do not use thinners
Working Times of Liquid Epoxies

FAQ:
- **Pot Life**: 5–7 Minutes of Working Time
- Allow~ 60–90 min for **Tack Free** coating
- **Cure Time**: ~ 4–6 hours before Handling & Backfill

Quality Control: Storage of Material
- **Warm / Hot Material**
  - Can dramatically reduce the pot life
  - 5 °F increase in material temp = 50% decrease in pot life
- **Cool / Cold Material**
  - Will be difficult to mix
  - Difficult to obtain a proper blend
  - Will be thicker and harder to spread
- Larger kits = more volume = shorter pot life
Applying Liquid Epoxies

- Apply by Brush, Roller, Applicator Pad or Plural Spray
- Apply to 25–40 mils per manufacturer's specification
Applying Liquid Epoxies – NGA Hands-On Workshop
Applying Liquid Epoxies

Quality Control:

- Measure coating thickness using a Wet Film Gauge
- Assure 25–40 mils per manufacturers instructions
- Check in (12–3–6–9) o’clock positions
- Be aware of coatings thickness – to thick can result in cracking
- Allow coating to CURE before handling or backfill
# Liquid Epoxy Cure Times

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Verify DRY-Film Coating Thickness

- Use Dry-Film Gauge
- Assure 20–40 mils as specified
- Check at various locations on pipe (12–3–6–9 o’clock)
- Recoat any LOW spots
QUALITY CONTROL
Durometer – Measuring Shore D Hardness

Minimum 75 Shore D
Quality Control

- Installers should take ownership – record name, date, time, etc.
Inspection, Handling & Backfill
Inspection

- Visual & Touch
  - Disbonded Coating
  - Holidays or Voids
  - Cracking, Alligatoring or Blistering

- Inspect Above & Below Grade

- Electrical Holiday Detector (Jeeping)
Jeeping – FBE & Liquid Epoxies

Holiday Detection

NACE RP 0490-2001

\[ V = K \sqrt{T} \]

Where:
\( K = 525 \)

\( T \) = coating thickness in mils
Polyethylene Coatings
- PRITEC®
- Cold Applied Tapes
- Heat Shrink Sleeves
Range 8000 – 12000 V
Formula:
\[ V = 1250 \times \sqrt{T, \text{ in Mils}} \]

EXAMPLE: PRITEC® 10/40 = 50 Mil thick
\[ V = 1250 \times \sqrt{50} \text{ or } (7.071) = 8,838 \text{ Volts} \]

Legend:
- \( V \) = Test Voltage
- \( T \) = Thickness
- \( \sqrt{\text{ }} \) = Square Root
- 1 Mil = .001 inches

FBE/Liquid Epoxies
- FBE Coated Pipe
- Liquid Epoxies
Range 1600 – 3000 V
Formula:
\[ V = 525 \times \sqrt{T, \text{ in Mils}} \]

Example: FBE = 16 Mil thick
\[ V = 525 \times \sqrt{16} \text{ or } (4) = 2,100 \text{ Volts} \]
Handling

- Allow proper time for Coating to set up
- Use Approved Slings and Harnesses
- Stored, Transported and Handled Properly
- Repair ALL damages related to Handling
Backfill

- Time Dependant on Coating Selection
  - Field coating the pipe is usually the last thing done before the ditch/trench is backfilled.

- Backfill Should be Free of Any;
  - Large Rocks
  - Stones
  - Foreign Objects/Materials

- The pipeline coating should also be protected from all rigid earth conditions, where coating penetration would cause corrosion to the pipeline
Thank You!